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TOTAL ECLIPSE OF JUNE 29, 1927, AT JOKKMOKK.

By W. J. LUYTEN.

After the successful expedition to Mexico in 1923 and the novel experience of observing the 1925 total eclipse in mid-ocean during a storm, the Hamburg Observatory was naturally making great plans for observing the total eclipse of June 29, 1927, on dry land, and much nearer home. As is well known, the path of totality for this eclipse passed over Wales, England, the North Sea, through Norway, then bent northward and ran almost parallel to the main mountain range of Scandinavia, passed through Lapland and into the Arctic Sea. A preliminary survey of the weather prospects showed that only northern Sweden, Lapland, offered as much as an even chance for clear weather. After careful consideration of everything involved, Professor Schorr, director of the observatory at Hamburg, and leader of the expedition, selected Jokkmokk as the site for his eclipse party. In addition to its being the only place in the track of totality where the chances of clear weather were more than fifty per cent, it also offered the advantage of being less popular than the more northerly towns, such as Gellivare. In fact the popularity, among prospective eclipse observers, for Gellivare was so great that (so we were told) the natives had early in the season begun to make bets as to who would be more numerous, the mosquitoes or the astronomers. Gellivare and Malmberget were visited by no less than two Swedish, two German, three Russian, one Polish, one Esthonian, and one Dutch expeditions. In Jokkmokk, where the hotel accommodations were even less favorable than in the iron district of Gellivare, our Hamburg expedition divided the honors (and the hotel rooms) with only one Polish expedition.

The writer of this article had been fortunate enough to obtain permission from Professor Schorr to join the party, but turned out to be even more of a liability than anticipated. Leaving Cambridge toward the end of May, and stopping over in Paris for the traditional American pilgrimage, I finally arrived in Tralleborg, the first stop on Swedish soil, on June 18. After a short visit to Lund, I at once went north to Stockholm, where, fortunately, the Soviet Embassy delayed me for four days, before granting a visa to enter the U.S.S.R. near Leningrad and leave it through Odessa. (Fortunately, since it gave me a chance to see the city, and marvel at the sense of humor of the population which built their new symphony hall on the fish market.) After a twenty-four

hour journey further north I arrived at Jokkmokk on June 25, four days before the eclipse.

Professor Schorr, Dr. Baade, and Dr. Schmidt had been there three weeks already and had practically completed the installation and adjustment of the instruments. Our equipment consisted of a horizontal telescope of 20 meters focal length, with a Zeiss objective of 160 mm aperture, and used with a coelostat. Professor Schorr personally took charge of this instrument. It was planned to make two exposures with it, a short one to show the prominences and another as long as possible, to show the corona. Dr. Baade operated a prism camera with Zeiss triplet of 100 mm aperture and 3.65 meters focal length, with an objective prism of 60° angle. As a novelty this instrument was equipped with a roll of film, 50 cm wide and 200 cm long, on which it was expected to make a dozen or so exposures of the flash. A third instrument, constructed and operated by Dr. Schmidt, had as the principal optical part a parabolic mirror of 55 cm aperture (which was actually diaphragmed down to 35 cm) and 11 meters focus. A fourth telescope had an objective similar to that used on the prismatic camera, but now was to be used, in conjunction with a coelostat, to make one long exposure on the corona. A few small, portable cameras completed the equipment.

The village of Jokkmokk, the ancient capital of the Lapps, is situated just above the arctic circle. This brings its inconveniences to the astronomer who is trying to adjust his instruments near the date of the summer solstice. Since the sun never sets there is no night, and all adjusting and focussing have to be done on the sun instead of on the stars. During the first two weeks Professor Schorr and his party were at Jokkmokk it was very cold, almost continuously cloudy, and in general offering bad prospects for the eclipse. On June 22, however, the weather changed, and, except for a short rainstorm, we had almost ideal conditions from then on; a day temperature running up to 100° F with a "night" drop to about 70 or 60. Real night of course does not occur at this time of the year, a thing hard to realize even for an astronomer, without having seen it. The phenomenon of the midnight sun itself, although interesting enough to justify staying up and watching it for a night or so, becomes rather tiring in the end. Our more southern natures are not tuned to this perpetual daylight; this becomes especially disconcerting when one finds out that the mosquitoes have adjusted themselves perfectly to this new way of living, and work in three shifts of eight hours each.

Since the eclipse happened in mid-summer, schools were closed, and the schoolmaster at Jokkmokk had kindly given permission to make our headquarters in the schoolhouse, about two hundred yards from the hotel. Among other things it provided us with an excellent space for a dark room, and with a well, where in spite of the high temperatures, we could always be sure to get icewater for developing. The air temper-

ature may be high during the summer months, but deep in the ground the winter never relinquishes its hold upon the arctic regions. Apart from the midnight sun, summer temperature, and ubiquitous ice-water, Lapland is blessed with prohibition, about as effective as on the Jersey coast. The Lapps, whom we had been promised to see, had disappeared. They had gone into the mountains in their quest for snow, and only a few specimens remained behind for parade purposes. During the summer months, the population of Jokkmokk, having apparently very little business to transact, had actually turned night into day, with the result that no breakfast was served before noon. As a special concession to us, who had to get up at five every morning to adjust our telescopes (the eclipse was scheduled for 6:42 A.M.) coffee and rolls were produced at eight-thirty. In spite of their nocturnal habits, however, the Jokkmokk people were sufficiently interested in the eclipse to get up at six that morning, and throughout the whole length of our stay we could always count on their coöperation in anything we wanted.

The day before the eclipse Dr. Kruse and Dr. Larink, both from the Hamburg Observatory, arrived, and that same afternoon before a large audience of the inhabitants of Jokkmokk we held our dress rehearsal. On the eclipse day itself we arose at five, much too early since the eclipse was not to happen until 6:42. We got what we deserved: an anxious half hour of waiting. At five the sky was beautifully clear, hardly a cloud being in sight. Gradually, though, as the sun rose higher and the eclipse time approached, clouds began to gather, and the sky darkened. At 5:45, the time of first contact, the sky was more than half covered, and at six almost entirely. Conditions grew steadily worse until, only a few minutes before second contact, the eastern sky began again to break. [The writer, who, on the afternoon of that day, broke out with measles, retired to the hotel at this point, and although still able to see the eclipse, was unable to observe it. The rest of the story is therefore given from hearsay.] The remaining crescent appeared and poured its sad rays over the arctic landscape. The sky favored us during the few precious minutes following and the whole program was carried out without a flaw during the 40 seconds of totality granted us at Jokkmokk. The consensus of opinion was that the corona was fairly small and faint as seen with the naked eye, although it appeared large and bright on the photographs. Two or three huge prominences could easily be seen with the naked eye, and were, of course, photographed with the 20 meter camera in one second. The two accompanying illustrations show the two photographs taken by Professor Schorr with this instrument, of one, and nineteen seconds exposure, respectively. A twenty-five second exposure made with the Zeiss triplet shows more extension of the corona, while the two photographs taken with the newly silvered mirror reveal a wealth of detail in the prominences, which is entirely masked in all other plates. Dr. Baade obtained a very successful series of twelve exposures of the flash spectrum and the coronal

spectrum, with exposure times ranging from 2 to 18 seconds and showing a good definition from Hα down to well beyond the limit of the Balmer series.

Immediately after the eclipse was over, great clouds again passed over the sun's disk, but we did not care, we were no longer interested. Telephonic messages from Malmberget and Gellivare soon brought us the gratifying news that, although thin clouds had been hovering over that region, the various expeditions there had almost all carried out their entire programs successfully.

REPORT OF THE MEETING AND EXHIBITION COMMEMORATING THE BICENTENARY OF THE DEATH OF SIR ISAAC NEWTON.

By FREDERICK E. BRASCH.

[*Continued from page 20.*]

Dr. E. W. Brown of Yale University presided at the afternoon program, and introduced Dr. M. I. Pupin of Columbia University who took as his topic

NEWTON'S DYNAMICS.

"The bicentennial commemoration of Newton's death turns our thoughts to his great achievements, and the greatest of them is his science of dynamics. This achievement is the crown of the scientific endeavors of the two centuries which preceded Newton.

"The most precious part of the Copernicus, Brahe, and Kepler triumph was the great dynamical problem which was suggested, and which can be stated in the form of the question: Why do the planets move in accordance with Kepler's laws? This question was a hopeless puzzle to the science of the sixteenth century.

"The problems of pendulum motions and of the motions of projectiles yielded to Galileo, but his dynamical science could not answer the question: Why do the planets move in accordance with Kepler's laws? Neither could the dynamical science of Galileo's successors who preceded Newton answer it.

"The momentum concept was created by Newton, and it is the most fundamental concept in his dynamics. His second law of motion expresses this fundamental character of the momentum concept by making its time rate of variation equal to the moving force. This measure of the acting and reacting forces not only conformed with the results of Galileo's experiments but, moreover, it shed new light upon them which was not visible to Galileo nor to any of Newton's predecessors.

It also agreed with all impact experiments, particularly with their revelation that during the impact of elastic bodies no momentum is lost.

"The analysis of these impact experiments in the light of the second law was very helpful in the formulation of the third law, the law of equality of actions and reactions. Newton's third law employs a terminology the importance of which cannot be overstated.

"Astronomical evidence supported Newton's answer and this assured the world that a new science, the science of dynamics, was born, and that Newton, inspired by Galileo, was its father. To this new science Newton added his great invention of a new mathematical art, the art of the differential and integral calculus."

Dr. Paul R. Heyl of the United States Bureau of Standards referred to

NEWTON AS AN EXPERIMENTAL PHILOSOPHER.

"Newton from his earliest years took delight in constructing mechanical devices, and his innate skill of hand served him well in later years.

"Newton is sometimes called 'the king of thought' but he was far from being merely a speculative philosopher. His reasoned conclusions were carefully tested by experiment wherever possible.

"Newton turned his acquired skill in the making of lenses to what was then the new art of grinding and polishing reflectors for telescopes. So skillful did he become in the construction of such reflectors that the best London opticians could not equal those of his production.

"Newton's skill with his hands was in part innate, but we must recognize that his superiority over the professional opticians of his time was doubtless due to the same cause that contributed to the excellence of the work of a certain painter, who when asked the secret of how he mixed his colors replied: 'With brains, sir!' Newton's knowledge of geometry guided his technique, and furnished suggestions which could not have been expected to occur to the mind of the artisan of those days.

"In the *Principia* as well as in the 'Opticks' there is to be found evidence of Newton's skill of hand and experimental ingenuity.

"Even the members of the Royal Society, a body of men selected for their excellence in scientific knowledge and attainments and, as the minutes of their meetings show, assiduous experimenters, bore witness to Newton's experimental skill. And yet I think that Newton would have been rather surprised had he heard himself described as an 'experimental' philosopher, and would have considered the expression tautological. The scientific specialization of our time was unknown to him. The term philosopher meant then what its etymology signifies—a lover of wisdom, and wisdom (it was beginning to be recognized) was to be found by questioning Nature by experiment."

The next paper was upon some historical

DEVELOPMENTS FOLLOWING FROM NEWTON'S WORK.

Professor E. W. Brown traced briefly the work of two centuries in following out the consequences of Newton's laws as applied to the moon and planets. "To predict the future position of a heavenly body we must know how it has moved in the past. Some 100,000 observations of the sun and moon alone have been utilized, and besides these many hundreds of thousands of observations of stars have been made to regulate the clock which is of equal importance with the telescope to secure the necessary information." These masses of observations are all bound together into one whole by Newton's laws of motion and of gravitation. The development of the consequences of the laws must be done by mathematical methods and some of the ablest mathematicians have devoted large portions of their lives to the work.

But the laws are not only applicable to the motions of the heavenly bodies, but also to all our terrestrial machinery. "The structure of a skyscraper, the safety of a railway bridge, the motion of a motor car, the flight of an airplane, the navigation of a ship across the ocean, the measure of time itself, depend fundamentally on Newton's laws. Many failures of our mechanical devices, especially of those which move at high speed, may be traced to lack of knowledge or lack of care in applying those laws.

"The essential characteristic of Newton's laws is their power to predict with certainty. It is a remarkable feat to be able to foretell successfully within a second of time a century hence the moment when the moon or a planet will be observed due south. In the ordinary routine of the astronomer it is regularly done, even more accurately, five years ahead, and the leeway necessary when the interval is extended is known. We have now arrived at the place where we have been able to measure the deviations from the laws themselves as well as the deviation from correct running of our time keeper, the earth, in its daily motion round its axis, but this would not have been possible without the most careful working out of the consequences of the laws. Much remains to be done in applying them to stellar systems, especially globular clusters and spiral nebulae."

The paper by Dr. Florian Cajori of the University of California was read by Dr. Lao G. Simons of Hunter College who gave in part the history of

NEWTON'S TWENTY YEARS' DELAY IN ANNOUNCING THE LAW OF GRAVITATION.

INTRODUCTION.

"The two explanations. It is well known that Newton in 1665 or 1666 first tested the law of universal gravitation, but that he did not announce the law until 1686. Before the year 1887, it was universally

accepted that Newton's delay of about twenty years in announcing this great law was due to his having used in 1665 or 1666 too small a value for the size of the earth, so that in applying his gravitational hypothesis to the earth's attraction for the moon, he obtained a theoretical result for the distance a body falls from rest on the surface of the earth in one second which did not agree with the experiment, and that he could not get the two results to agree until the Frenchman, J. Picard, supplied a more accurate geodetic determination for the size of the earth.

"At the two hundredth anniversary of the publication of Newton's *Principia,* in 1887, the astronomer, J. C. Adams, and the mathematician, J. W. L. Glaisher, advanced another explanation of the twenty years' delay. They stated that in 1666 fairly accurate values of the earth's radius were known and that the real cause of the delay was the question how a sphere attracts an outside particle. This question Newton did not clear up until sometime in 1685, and not until then did he consider valid his proof of the law of gravitation, as applied to the earth and moon.

"Aim of this article. It is the purpose of this paper to make a searching study of what was really known in England respecting the size of the earth, before Picard made his measurements, and to subject the entire question of Newton's delay to a critical examination."

The paper was divided into five parts as follows: British views of the size of the earth before 1671; Newton's gravitational calculation of 1665 or 1666; Newton's apparent indifference during 1666-1685 to earth measurements; An essential step in proving the law of gravitation; and Conclusions.

The first paper for the second morning's program was by Dr. L. C. Newell who also presided at this session.

Professor Newell, head of the chemistry faculty at Boston University's College of Liberal Arts, spoke on

NEWTON'S WORK IN ALCHEMY AND CHEMISTRY.

"Throughout his career as an experimenter in alchemy, Newton was a philosopher searching for a clue to some great generalization concerning the nature and properties of matter.

"Although Newton conducted many chemical and alchemical experiments continuously for about 35 years, from 1661 to 1695, in his laboratory beside the great gate of Trinity College in Cambridge, his chief purpose does not seem to have been transmutation of base metals into fine gold, but rather a diligent search for a great principle, which would transform disconnected chemical phenomena into a philosophic system. He was not an alchemist in the usual meaning of the term, with its unethical implications.

"Newton's early interest in chemistry is indicated by items in a notebook which has been assigned to his preadolescent years." Professor

Newell went on to say. "Among the 'strictly chemical' items, which the boy had written down were directions 'for making allum water,' 'How to make lime water,' 'How to melt mettle quickly yea in a shel,' and a prophecy of what chemists of the future were to strive for seriously, 'a color for faces.'

"Newton experimented assiduously in chemistry and alchemy in the many years he spent at Trinity College, Cambridge, as a student, fellow, and professor."

Commenting upon Newton's idea of atoms, as set forth in his work on "Opticks," Professor Newell declared that Newton was not far from certain aspects of our modern views on the constitution of matter. "Indeed, if this statement of atoms, and if many of the queries propounded in the 'Opticks,' were stripped of their trappings and rewritten in modern terms, I think we would be compelled to appraise Newton's views as closely approximating modern interpretations of the constitution and behavior of matter."

Dr. George S. Brett of the Department of Philosophy of Toronto University presented a paper on

NEWTON'S PLACE IN THE HISTORY OF RELIGIOUS THOUGHT.

"Newton's relation to the history of religious thought is defined partly by the actual work which he did on passages and books of the Bible, partly by the general influence which he exerted on the thought of the eighteenth century. In this paper reference is made to the specifically theological writings but more attention is paid to the effects which his ideas of law and order produced upon writers who were concerned to follow his example in reconciling science with religion. The mechanistic philosophy of the eighteenth century was largely due to the attempt of the Newtonians to restate the principles of religion in a way that reconciled them with the idea of a universal reign of law. This idea of law as opposed to the purely sentimental or pietistic view of religion is taken to be the most permanent effect of Newton's work and is held to be the aspect of the subject which most clearly persists to the present time. Though this influence is indirect and is due to the application of Newton's ideas rather than to his own statements, it is the most important aspect of his relation to the progress of thought on religious questions."

Mr. George E. Roberts, Vice President, The National City Bank of New York, and former Director of the United States Mint, in Washington, D. C., gave an address on Newton in the Mint, namely,

"Newton's appointment in the Mint was eminently fitting in every respect but not without a political bearing. He had represented the University of Cambridge in the Parliament which established William and Mary on the throne, and Macauley says that he was the glory of the

Whig party. The immediate occasion, however, was the problem which confronted the Government in dealing with the coins in circulation, which had been clipped and debased until the currency situation was intolerable. Macaulay's account of the Government's inability to make new coins circulate while this old money was in circulation at the same legal tender value is the classic illustration of Gresham's law that 'Bad Money will drive out Good Money.'

"Newton was invited to accept the position of Warden of the Mint in 1696. It was not the highest office in the institution, but he was made Master of the Mint three years later, and held that place until his death in 1727. He discharged his official duties with fidelity and energy, particularly during the great recoinage which lasted three years.

"The recoinage, however, did not end the monetary problems. When the old silver coins were completely replaced it was found that the new coins were being exported because they were undervalued in comparison with the gold coins, and thus the Government was confronted with the problem which vexed the world for the next 200 years, to-wit: how to make the two metals circulate concurrently upon equal terms under free coinage for both. The Government addressed a letter to Newton asking his advice. He replied that silver was sent out of the country because it was more highly valued in proportion to gold elsewhere, and suggested that the gold coins might be reduced in weight, but intimated that is was hardly worthwhile because the relative values probably would change again shortly. His letter was a model of clarity as far as it went, but became a subject of a controversy between the partisans of bimetallism and the gold standard which lasted until practically the entire world had adopted the gold standard. Both sides sought to use the authority of his great name, but he proposed nothing more than a tentative adjustment of values, for which there were precedents. Evidently he fully comprehended the economic laws governing the fluctuations of the two metals, but he did not discuss the fundamental difficulty involved in trying to maintain two standards of value at the same time, or say anything about the theory of alternative standards."

The last paper was on

JOHN WINTHROP (1714-1779) AMERICA'S FIRST ASTRONOMER AND THE FIRST DISCIPLE OF SIR ISAAC NEWTON IN THE COLONIES.

by Frederick E. Brasch, Library of Congress, Washington, D. C.

"The history of science in the American colonies centered itself in the work of John Winthrop, Hollis Professor of Mathematics and Natural Philosophy at Harvard College from 1738 to 1779. Winthrop graduated from the famous Boston Latin School and entered Harvard College where he became the leading scholar of his class. He was appointed to the professorship at the early age of twenty-four years and

almost immediately assumed the honor position as a scholar of great ability. His principal work was, however, in the field of astronomy and he made such notable observations upon sun-spots, and transits of Mercury and Venus, that he was honored by election as Fellow of the Royal Society of London. With the coöperation of the College authorities and the Colonial Governor he was able to embark upon the first astronomical expedition that this country has ever undertaken which was in 1761. Winthrop's mathematical ability led him to the more advanced studies which were now to be found in the works of the great Newton, and he soon secured for himself a copy of the *Principia Mathematica,* third edition 1723. This was the second copy known to be in the colonies. Yale College secured the first, namely one of the second edition of 1713. The work resulting from Winthrop's studies of the *Principia* now revealed the true character of our scholar, for he was the first to introduce the subject of fluxions (calculus) in the colleges about 1751, also the first to establish a laboratory of physics for experimental purposes in 1746. All of Winthrop's subsequent work in astronomy was based upon the *Principia.* He was somewhat of a seismologist, and advanced the science of meteorology by his long series of recorded observations. He also made observations of the northern lights. During Winthrop's long period at Harvard College he was offered twice the Presidency, but refused due to not too good health. He was honored, however, as no man of his time, as a scholar and scientist as well as an ardent patriot—for he espoused the cause of Washington, Adams, and others, whose friendship and counsel were always sought. Winthrop was the first scholar to receive the honorary degree of LL.D. from Harvard College, which he also received from the University of Edinburgh. His contemporaries at home and in England recognized Winthrop as the first Newtonian scholar in the Colonies. His equals may have been Halley, Bradley, and one other in England. Winthrop died at the age of 65 in 1779, and lies buried in the King's Chapel church yard in Boston along with his ancestors, the first Governor of Massachusetts and the first Governor of Connecticut."

The great exhibition of books, portrait prints, letters, autographed documents, and medallic illustrations of Sir Isaac Newton, and of his mathematical contemporaries, which supplemented the addresses, were all arranged in suitable cases on three sides of the hall in which the audience gathered. This most imposing collection probably will never be duplicated at any one time and in itself constituted one of the richest contributions to that phase of the history of science which goes to make this subject interesting and fascinating. The labor and excellent arrangement of these beautiful memorials was carried on under the personal direction of Dr. David Eugene Smith. From Dr. Smith's private collection came 125 of the most exquisite and beautiful portrait prints of Newton, of various ages and painters; also 25 medals from about

that many engravers, and also the largest assortment of letters and autographed documents. Dr. Smith loaned also over 40 various editions of Newton's Principia, Opticks, Fluxions, Universal Arithmetics, as well as essays on Newton's life and work.

Besides the Newton material from this same private collection, came portraits and autographed letters of Halley, Barrows, Cotes, Wren, Wallis, Huyghens, Cassini, all friends and co-workers of Newton. There were also exhibited portraits of Flamsteed, Leibnitz, Descartes, Bernoullis, Wolf, Gauss, LaPlace, Gassendi, Pascal, Kepler, Galileo, and Copernicus. Most interesting probably was a collection of letters from Leibnitz to Newton with notes in Newton's handwriting. This copy of bound letters was from Newton's private library. Another collection of letters to Newton came from four generations of Astronomers Royal of France, the Cassini family, to whom Newton was indebted for his data on the size of the earth. From the Babson Institute, Wellesley, came also a magnificent collection of 36 items representing the various editions of Newton's work, the most interesting and valuable being a copy of the first edition of the *Principia Mathematica,* 1687, and one of the re-issue of the same book. The first item contained notes and corrections in Newton's own handwriting. There were copies of the 1713 edition of the *Principia,* edited by Cotes with an enlarged chapter on the Lunar theory and of Comets, and the 1726 edition by Pemberton, the last published during Newton's life time. There was also a copy of Newton's *Opticks,* 2nd edition, with notes in his handwriting. All these contained Newton's bookplate and autograph, showing they were from his private library. Besides these there were a collection of portrait prints of Newton, and a cast of the sundial as well as of his inscription cut on the window sill of the Grantham grammar school.

From Mr. George A. Plimpton's (New York) great collection of Rara Arithmetica came 12 items of Newtonia, collected works, as well as single volumes. One item was Newton's copy of a Journal with his signature and numerous notes.

Through the courtesy of Dr. A. Keogh, Librarian of Yale University, were loaned two books by Newton which have more than passing interest. A copy of the *Principia,* 1713 edition, and of the *Opticks,* 1706 edition, were presented to the colonial college in New Haven in 1714 by Sir Isaac himself.

Through the courtesy of Dr. F. C. Newell of Boston University, Dr. S. Brodetsky, Leeds University, and Grantham Public Library, came an interesting collection of prints, pamphlets, and newspapers giving an elaborate account of the Newton birthplace, of his boyhood and of the bicentenary celebration at Grantham on March 20, 1927.

Six interesting photostat copies of various leaves of a precious commonplace note-book of Newton, when a boy of 17 years, were exhibited. The original note-book is in the Pierpont Morgan Library, New York.

Mr. James Stokely of Science Service exhibited a copy of Riccioli's *Almagestum Novum* which came from Newton's library with his annotations, and Dr. Florian Cajori, University of California, exhibited single special items bearing upon Newton's religious writings. Space will not permit of further details.

Following are the members of the

COMMITTEE ON ARRANGEMENTS.

Dr. Lao G. Simons, *Chairman*, Hunter College, New York.
Dr. Vera Sanford, The Lincoln School, New York.
Miss Frances M. Clark, Teachers College, New York.
Miss Helen Walker, Teachers College, New York.
Dr. Lester S. Hill, Hunter College, New York.
Mr. John A. Swenson, Wadleigh High School, New York.

LIBRARY OF CONGRESS, WASHINGTON, D. C.

THE 30-INCH REFLECTING TELESCOPE AND PHOTOELECTRIC PHOTOMETER OF THE UNIVERSITY OF ILLINOIS OBSERVATORY.

By ROBERT H. BAKER.

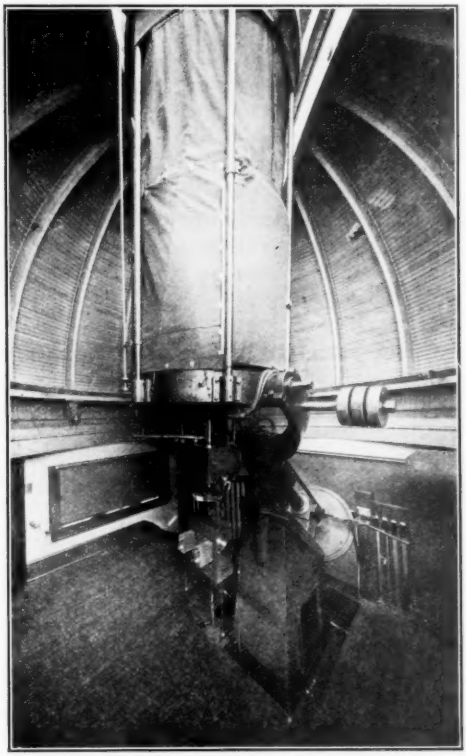
Three years ago the University authorities assigned funds to the Observatory to be used for reconstructing a 30-inch telescope in our possession and for building a new photoelectric photometer. Since the apparatus is now completed and in service, a preliminary account of some of its features may be of interest.

The original telescope was made by the Brashear Company after the specifications of an individual whose plan was apparently not astronomical. According to one account he purposed using it as a burning glass for manufacturing diamonds. Another story is that he expected to observe the flight of souls. However this may be, the instrument was finally on the market at a very small price and my predecessor, Professor Joel Stebbins, recommended its purchase by the University. The telescope was quite as unusual as its original purpose appears to have been. The 30-inch mirror had a focal length of only 20 inches and such necessarily imperfect definition that it was not the easiest matter to distinguish between a star and the moon.

A 15-foot dome was erected in 1914 on the Campus south of the Observatory and the telescope was installed awaiting a more favorable opportunity to put it into active service. Stebbins then returned to his pioneer photoelectric program with the 12-inch refractor. Eventually the problem of what to do with the reflecting telescope was inherited by the writer. In the meantime the development of the Campus in the direction of the Observatory and beyond made this site no longer

favorable for astronomical research. Consequently before the reconstruction began, the dome was moved to a more secluded place a quarter mile farther south.

Disks of borosilicate crown glass for mirrors were furnished by the Spencer Lens Company and figured by John E. Mellish. The primary mirror is 29½ inches in diameter and 4 inches thick, with a 4-inch hole in the center. The secondary is 7 inches in diameter. The focal length of the primary is 75 inches, so that its ratio is 2½ to 1 instead of the



THE 30-INCH REFLECTING TELESCOPE.
(Photograph by Eldredge.)

customary 5 to 1. At the focus of the Cassegrainian combination the ratio is 12 to 1. The satisfactory definition of the telescope, notwithstanding its unusually short focus, offers additional testimony to Mr. Mellish's optical skill.

All mechanical and electrical work on the telescope and photometer

was done by the J. B. Hayes Machine Company of Urbana. Mr. Hayes' experience with photoelectric projects extends over many years, first with Stebbins and Kunz in the pioneer investigations at this University and later with the writer in the numerous experiments we performed on the old photometer preliminary to the design of the new one. The actual construction and wiring of the photometer was placed mostly in the hands of Mr. A. E. Wood, instrument maker of this Company, who is responsible as much as any one for the successful outcome.

The telescope tube is formed by six 1¼-inch brass rods which fasten at the bottom to the iron cell of the primary mirror and at the top to an aluminum ring. Within this ring the secondary mirror is supported by four flat rods. Crossed braces between the brass rods give the required degree of rigidity to the tube. The telescope is focused by racking the secondary mirror which is conveniently done from the floor. The canvas cover of the tube is easily put on and removed.

Only minor changes were made in the mounting of the telescope. Clamps and slow motions are mostly new construction, and the driving clock required rebuilding because of the additional load. The fork type has one disadvantage, namely that when the photometer is attached, it becomes impossible to observe north of 70° declination. However, there are compensations. Reversing of the telescope is, of course, eliminated. The observer changes position very little. Moreover, since most of the telescope is above the axis, the photometer may be made as substantial as can be desired. Although the photometer weighs 300 pounds, additional weights are required to balance. Long weight-rods are attached at the ends of the declination axis. They are useful also in moving the telescope.

The photometer (Plate V) is supported by four 1-inch brass rods which project from the top iron plate down through the cell box. Just below the top plate is the sector box. In the illustration the cover is pulled out so as to show the small motor attached to it. Circular aluminum disks with sectors cut out on opposite sides fit over the lower end of the motor axis. When a sectored disk is in place, the box closed, and the motor started, the beam of starlight is reduced in intensity the desired amount. For the best results the difference in brightness of two stars to be compared should be reduced to not more than 0.5 magnitude. In the old photometer neutral shade glasses are interposed to produce this result. The advantage of the sector, if any, is that it certainly eliminates selective absorption.

The beam of starlight is brought to focus at the bottom of the sector box where it passes out through a half-inch opening. Immediately above focus provision is made for the introduction of smaller diaphragms and color filters. Below the sector box the setting eyepiece points toward a reflecting prism which may be racked into the beam. When the star is central in the eyepiece and the prism is withdrawn,

the light is then directed properly into the cell box. When observations are in progress, the setting eyepiece is turned to the left. Then as the observer stands to the left of the photometer he has within reach all the devices needed for setting on the star.

As the light enters the cell box it encounters a quartz reflecting prism which may be rotated 180° by pulling one of the back pair of strings. The light is here diverted into either of the photoelectric cells. From this point downward we have practically two photometers side by side. Quartz cells of the Kunz-Stebbins type are used. They are manufactured by the Cooper-Hewitt Company and filled by Professor Jakob Kunz of the University of Illinois. So far as I know, these cells are unsurpassed in sensitiveness and dependability.

When the beam of starlight, now about 6 inches below focus and therefore ½ inch in diameter, enters through the clear window of the cell and falls on the sensitive surface, it produces the well-known photoelectric effect, namely the discharge of electrons in number proportional to the amount of light. A positive potential of 300 volts or less on the anode of the cell draws the electrons away from this surface, which, assisted by ionization by collision, becomes positively charged at a rate depending directly on the brightness of the star. A fine platinum wire connects the anode of each cell with the corresponding electrometer where the effect is measured. Between cell box and electrometer case the connecting wire passes through several disks of amber which are set in a flexible coil of wire. The two coils are covered by a cemented strip of inner tubing. With this arrangement the electrometer case may hang vertically from the gimbals whatever the pointing of the telescope.

The electrometers follow closely the design of the one now in use at the Lick Observatory, which was built in the shop of the Physics Department at Berkeley. Drawings and specifications of this instrument were made available through the courtesy of Professor E. P. Lewis. The Lick electrometer was in turn patterned in its main features after the older one of the University of Illinois Observatory. The new electrometers are identical. Each has two knives whose distance apart, normally about 1 cm, may be varied by turning graduated knobs. When they are in use the knives carry charges of 75 volts, of opposite signs. A fine platinum suspension between the knives is attached above and below to a compensating system, so that the tension on the wire remains fairly constant. Further protection against rapid temperature changes is afforded by the felt jacket (removed in the illustrations) which covers all parts of the electrometer case. Some expense and trouble connected with building of the electrometers might have been saved, if we had adopted a more recent and compact type. But the merits of the newer instrument were unknown to us three years ago when the present installation was begun.

Until recently the breaking of the electrometer suspension was

reckoned a major catastrophe in this Observatory. The suspensions are 4 inches long and only .0001 inch thick. They come to us as Wollaston wire; the platinum core is surrounded by a silver jacket which must be dissolved in a solution of nitric acid. But in the removal of the silver the platinum core often broke into many pieces. Either the core had become discontinuous where the Wollaston wire was drawn out, or the silver jacket dissolved unevenly owing to tarnish, or some other factor entered to cause the trouble. Whatever it was, the mortality of new suspensions appears to be greatly reduced by a preliminary bath in potassium cyanide solution.

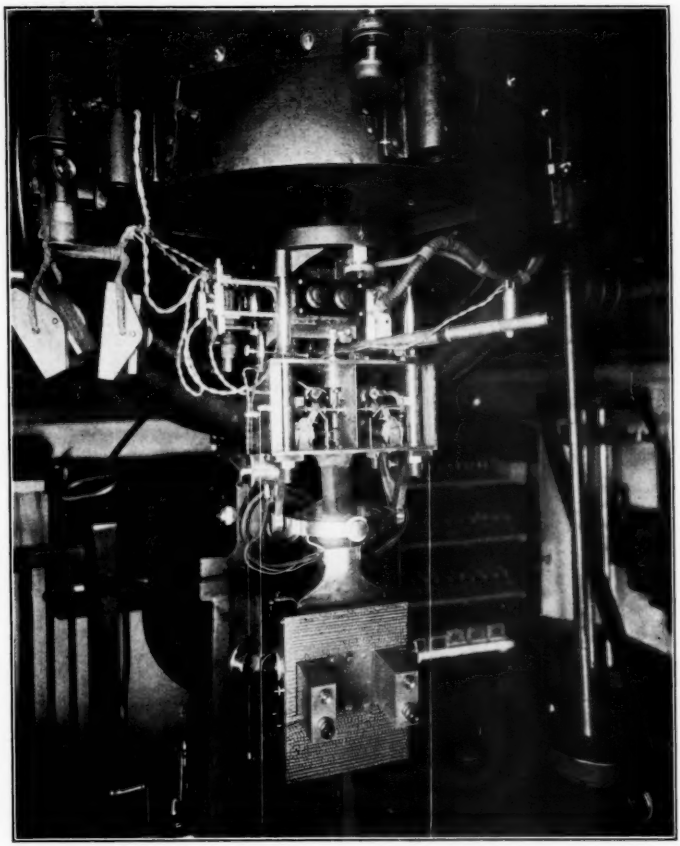
Through the microscope of each electrometer a small section of the vertical suspension is seen against a horizontal scale of 100 divisions. As the positive charge on the cathode of the cell increases through the agency of starlight, the suspension stretches toward the negative side of the electric field between the charged knives. The wire appears to travel across the scale and its speed, over say 10 divisions, measured with a stop-watch determines the star's brightness.

The pair of strings in front operates mechanisms in the cell box for making and breaking contacts between two rods and the two wires which connect the cells with the electrometers. By means of switches, which are below the sides of the cell box, the rods are connected either with the ground or with the positive terminal of a 1.4 volt standard cell. Thus the suspensions may be grounded and returned to zero positions, or they may be charged to a known positive potential, so that the sensitiveness of the apparatus is kept under control.

The use of two complete photometers is a unique feature, so far as I know. At the outset it was the intention to employ a single electrometer and two or more cells which could be connected with it successively. In fact such an arrangement was tried in several ways on the old photometer, always with unfavorable results, so that I abandoned sliding contacts in the new design. At present we have a caesium cell in one compartment of the cell box; in the other we use a potassium or sodium cell. With this combination we hope to be able to deal with the quality as well as the quantity of the light.

A miniature lamp behind the prism of the setting eyepiece and another lamp below the prism in the cell box, both fed by a storage battery and controlled by rheostats in front of the sector box, serve to illuminate the photoelectric cells before observing begins at night and for various tests in the daytime. A battery of standard cells of the Clark-Carhart type, each giving about 1.4 volts, provides potential for the anodes of the photoelectric cells. Dry batteries serve for charging the electrometer knives. All electrical circuits, except some parts of the power and lighting circuits, are carried in grounded conduit. Dried air is bubbled continually into the cell box whence it flows into the other vital parts of the apparatus. As an additional precaution tubes of sodium are kept at strategic points. So far the photometer has per-

PLATE V



THE PHOTOELECTRIC PHOTOMETER OF THE ILLINOIS OBSERVATORY.
(Photograph by Eldredge.)

formed faithfully regardless of the degree of humidity in the dome.

Other uses may well be made of the telescope, especially because of its short focus. It requires only a few minutes to disconnect the photometer and roll it out of the way on the dismounting carriage. But for the present the photometer will be used exclusively.

FIREBALL OF FEBRUARY 27, 1927.

By CHARLES P. OLIVIER.

About 9:00 P.M., E.S.T., on February 27, 1927, a very brilliant fireball passed over the southern part of North Carolina, moving from west to east. My attention was called to it five days later by Dr. Ivey F. Lewis, of the Department of Biology, University of Virginia. He gave the names of two men living near its reported path who might aid in securing information. One of these, the Hon. Chas. G. Rose of Fayetteville, N. C., had notes published in local papers asking for information, and also personally interviewed several persons who sent in data. It is mostly due to his generous assistance that the material on which this paper is based was secured.

In addition, standard questionnaires were sent to many high school superintendents and some other persons who lived near the reported path. Some replies were received from these sources. Several newspaper clippings were also sent in, but as usual they were singularly lacking in any information of value. Due to delay in getting the names of the proper parties, it was some weeks before all could be reached and replies received. This meant that recollections had been somewhat confused by time, and hence the data are not so good as the same persons could have given had it been possible to reach them immediately.

However, despite this handicap, 15 persons sent in letters or filled out questionnaires, or sometimes did both. This does not include a few negative replies. And it is upon the replies of these 15 persons that our results depend. The writer has condensed the information into tabular form, for ready reference. In some cases certain questions were obviously misunderstood, as they would be contradicted or modified by answers to others. Each case has been carefully studied and the most probable inference drawn as to the observer's meaning. Such cases are followed by the letter *a* in the table. When inches were used to describe the diameter, the writer assumed that it was thought that the moon is 12 inches in diameter (the usual estimate) and reduced their inches at the ratio 1 inch equal to 2½′. These cases are denoted by the letter *b*.

Mr. J. W. Ferguson, a surveyor, made actual instrumental measures of the end points of the path. His results obviously deserve greater

weight, and in the determination of the azimuths of the end points this has been taken into consideration. But for his results the body's path would have been located about 10 miles to the south of the path finally chosen, and parallel thereto. However, this would not have appreciably changed the elements of the orbit, nor the heights, derived from our data. In general preliminary computations showed that the observers estimated the altitudes much better than the azimuths, so that for altitudes all results were given equal weight. As Mr. Ferguson's fell very near the mean, for each end point, not increasing the weights of his observations made little change in the derived heights.

The procedure followed for such fireballs is to plot the azimuths of the observed end points upon a map of the state crossed by the object and then study the intersections of these lines. Were all observations perfect, when slight corrections are made, they should intersect in two points. Actually they always cover two large areas. It is our task then to find the most probable points in these two areas, on a basis of a close study of the original observations, by trial and error methods. Rigorous solutions would be a waste of time, and the graphical solutions lead to satisfactory results. When these two points, the projections of the ends of the body's path, have finally been determined, we measure on the map the distance of these from each station. Using the observed altitudes we can then calculate at once the vertical distance the object appeared above the earth as seen from each station. Again we find a certain range of values and must take the mean. When these vertical heights are calculated, we get the projected length and true length of path, its angle with the horizon, and the azimuth of its direction of motion. Next we calculate the point it would have struck the earth had it continued in a straight line. The longitude and latitude of this point is our origin and for this we determine our local time. The direction and slope of the body's path give the altitude and azimuth of its apparent radiant. This is next corrected for zenith attraction and from here on the computation becomes the standard one for a meteor's orbit.

A brief résumé of the derived data follows.

Height of appearance (7 observations)	76.2 ± 18.4 miles
Height of disappearance (9 observations)	18.8 ± 5.4
Length of path	116
Projected length of path	100
Slope of path	29° 54′
Azimuth of path	268°
Began over	Long. 79° 44′ Lat. 34° 49′
Ended over	78 0 34 52
Origin	77 28 34 53
Local Mean Time	$8^h\ 50^m\ 08^s$
Observed velocity	17.5 miles per second
Zenith attraction	2° 50′
Radiant	R.A. 43° 11′ Decl. +13° 30′

Observer and Station	Time h m	Color	Apparent size	Duration in seconds	h_1	a_1	h_2	a_2	Slope to horizon	Side of Zenith	Interval Seeing to Hearing Explosion in Minutes
Brice, R. B., Bladensboro, N. C.	8 55	Rainbow		30	..	W	..	E	..	..	3
Byrd, Mrs. W. C., Charlotte, N. C.	9		>Venus *a*	..	..	E	0°	E	..	..	..
Clark, E. C., Clarkton, N. C.	8 35*a*	Red	8′ *b*	12-15	..	NW	..	225 *a*	..	W	1
Curtis, K. R., Kinston, N. C.	9	Light red	10 *b*	4	45°	SW	30	SW+	20	S	..
Ferguson, J. W., Trenton, N. C.	9 00		8	5	30	84	21	71	32	..	..
Frink, M., Bladensboro, N. C.	9	Purple	30	15	90	W	75	NE	..	..	2
Goodman, Rev. W. H., Clarkton, N. C.	8 55*a*	Very red	½Moon	..	..	W	..	250 *a*	..	5°N	2
Greaves, Rev. C. L., Raleigh, N. C.	9	Yellow red	>Venus	2-3	..	..	15	S	5+	S	..
Lemon, S. L., and Murphy, Miss M., Conway, S. C.	9 30*a*	Yellow red	Moon<	1½	35	?	15	?	..	N	..
McMillan, A. B., and Mrs. McMillan, 12 miles east of Kenansville, N. C.	9 15	Bt. purple	=Moon	45	35	45	20	292 *a*	15	S	..
Parsons, G. B., Clarkton, N. C.	9	Red	Moon<	10	..	?	low	ENE	..	..	2
Pridgen, Mrs. W. H., Creek, N. C.	9	Red *a*	Moon< *a*	..	..	..	15	357	..	..	..
Roller, A. F., Raleigh, N. C.	9	Yellow	=Moon	1	40	45	20	338 *a*	45	S	..
Sutton, Q. J., 4 miles southeast of Kinston, N. C.	9 00	Red-yellow	⅔Moon	5	20	65	15	45	15	S	..
Vickery, P. L., 4 miles east of Fayetteville, N. C.	9 10*a*	Red-yellow	=Moon	10	45	68 *a*	30	SSE	20-25	15°S	..

	Orbits.	
	Parabolic	Hyperbolic
Long. of Apex	247° 42′	247° 42′
Ascending Node	158 30	158 30
Inclination	0 54	1 28
Long. of Perihelion	143 8	142 2
Perihelion distance	0.966	0.961
Eccentricity	1.000	2.59
Semi-major Axis	∞	—0.61

While the data are too uncertain to give any great weight to these elements, still some things seem certain. Namely that the body moved with direct motion, almost in the plane of the ecliptic, and had a large perihelion distance. No reliance can be placed upon the other elements except node which is merely the position of the earth at the moment.

An inspection of the table shows that the color was undoubtedly a yellowish-red, and that the apparent diameter of the body was comparable to that of the quarter moon. Five observers heard roaring like heavy thunder after the body had passed. All these five were in either Bladensboro or Clarkton. Many of the observers report that they saw the actual explosion at end of path. A fiery trail was left. Mr. Ferguson made a careful estimate of 3° as its length just before the body exploded. This trail was reported more yellow than the fireball itself. Newspapers reported that windows in houses situated in Robeson, Bladen, and Columbus Counties were shaken by the explosion, which sounded like the report of dynamite at a distance. The meteor is further reported from Fayetteville to have exploded three times, two being of minor importance. The body evidently gave out a very intense light, probably fully equal to half that of the full moon.

From the reports it appears clear that the sound phenomena were due to the "shock-wave" rather than to the actual final explosion. This opinion is corroborated partly by the heavy thunder-like sounds being reported from Bladensboro and Clarkton to the side of the path, but not from Kinston or Trenton toward which the body was moving. Yet all four places are nearly equally distant from the end point where the final explosion took place.

Summing up, we have here the case of a brilliant fireball for which enough data were observed to give a general idea of its height, length of path, and orbit. As it exploded so high above the earth and no parts were seen to fall, the chances of ever finding any fragments are remote, if indeed any of appreciable size survived the final explosion.

The writer is under great obligation to all the persons mentioned who aided by sending in their observations, but most especially to the Hon. Chas. G. Rose of Fayetteville, N. C., due to whose efforts most of the observers were reached. But for this generous aid the results herein contained could not have been deduced.

In closing, the attention of all readers is called to the importance of making careful notes on any brilliant meteor they see. In a lifetime the

average person will see only a few fireballs, so the burden of making the notes is small. If people who are even superficially interested in science would report such cases, results of value would be far more numerous and meteoric astronomy would advance much more rapidly.

LEANDER MCCORMICK OBSERVATORY, UNIVERSITY OF VIRGINIA.
January 7, 1928.

AMERICAN ASTRONOMICAL SOCIETY.

REPORTS OF OBSERVATORIES
1926-1927

[*Continued from page 39.*]

HARVARD COLLEGE OBSERVATORY

CAMBRIDGE, MASSACHUSETTS

(For year ending October 1, 1927)

Progress has been made in the Observatory's work on proper motions, globular clusters, nebulae, variable stars, meteors, and spectrum analysis and classification, but the outstanding events of the past year are the transfer of the Boyden Station to South Africa and the provision of a large reflector for the southern hemisphere. Not for three decades has the Observatory made such substantial advance in material equipment as is represented in the present enlargement of the southern station.

Generous gifts to the Observatory this last year from the International Education Board and from Harvard University have provided for the construction and endowment of a 60-inch reflecting telescope of modern design. It will be the largest telescope in operation in the southern hemisphere. One of the Common mirrors already in the possession of the Observatory, refigured to the necessary extent, will be the main optical part of the telescope. The mounting is to be of the two-pier type, and will be arranged for use in both the Newtonian and modified Cassegrainian combinations. The construction of the mounting, which is in the hands of J. W. Fecker, is well advanced.

The Bruce 24-inch telescope has in past years been one of the most productive instruments in the southern hemisphere despite its poor mounting. It has produced the plates for the studies of the Magellanic Clouds, southern nebulae, Milky Way structure, and the star clusters. Its removal from Arequipa affords the opportunity for a new mounting of the two-pier type. Mr. Fecker has received the contract also for this work, which is nearly completed. With the new mounting the telescope

will be used in the Observatory's extensive programs on proper motions and faint nebulae.

The new funds mentioned above also provide a mounting for the Metcalf 10-inch triplet, which in the past has been accommodated on the mounting of the 8-inch doublet. The new mounting has been purchased and tested, and will soon be installed in South Africa. This telescope is one of the important features in the study of variable stars in the Milky Way.

Special gifts from Mr. George R. Agassiz and Mr. Gerard Swope have provided for the making of two 3-inch lenses of the new Ross type, to replace lenses now used in the sky patrol. The lenses have been constructed, and if they prove on testing to be as satisfactory as is anticipated, we may look forward to a new epoch in the effectiveness of the Harvard sky patrol. Larger scale, high speed, and better images over the whole field seem to be assured.

The moving from Arequipa to Bloemfontein was begun in November, 1926. The telescopes, library, and incidental equipment were shipped to Bloemfontein by way of New York in February of this year and in July Dr. Paraskevopoulos, superintendent of the southern station, and Mrs. Paraskevopoulos arrived in South Africa.

The new permanent site of the station has now been located on a low kopje at Mazelspoort, the waterworks settlement of Bloemfontein, fourteen miles northeast of that city. The altitude is approximately 4500 feet, the longitude $1^h\,45^m\,37^s$ east, and the latitude $29°.2$ south. All available evidence indicates that the new site will be superior to that at Arequipa, especially in the avoidance of an unbroken cloudy season, which greatly hindered the work in Peru from December to April. Pending the building of a road to "Harvard Kopje" and the construction of permanent buildings, a temporary installation of two telescopes has been made at Mazelspoort. Observations were resumed in September on the southern sky patrol and on southern galactic variable stars.

New Research Fellowship. A long-standing need of the Observatory has been met this year through the endowment on a generous scale by Mr. George R. Agassiz of a research fellowship for an advanced student in astronomy. The first holder of the fellowship is Mr. Frank S. Hogg, B.A. (Toronto), M.A. (Harvard), whose researches in spectroscopy are referred to below.

Space prohibits the description of the Observatory's problems or a general account of any phase of the researches in progress. The annual bibliography has grown too large for inclusion in the report, as in former years. It seems advisable to give here only an abbreviated summary of the results of the year's investigations, omitting mention of a number of the minor researches which are summarizéd in the full report to the President of the University.

The Discovery, Classification, and Measurement of Nebulae. Ap-

proximately eight thousand new nebulae have been found on photographs, averaging about three hours exposure, made at Arequipa with the 24-inch Bruce refractor. Two-thirds of these nebulae are in the southern hemisphere, and nearly all belong to the extra-galactic class.

A new descriptive classification of nebulae, in which the form and central concentration of the photographic image are the salient features has been formulated. Earlier systems of classification of extra-galactic nebulae have proved unsuitable for the thousands of faint objects shown on the Bruce photographs.

The detailed study of the region of the Coma-Virgo cloud of nebulae has been continued by Miss Ames, who is making a catalogue that will include not only the positions, angular dimensions, and classifications of more than two thousand nebulae, mostly new, but will also contain integrated magnitudes on a fairly reliable scale. Probably only the two hundred brightest nebulae belong to the Coma-Virgo cloud; the other objects, fainter in general than the sixteenth magnitude, are much more remote, possibly at distances of the order of one hundred million light years.

An examination by Dr. Shapley of long-exposure Harvard photographs failed to verify the existence of the many dark nebulosities in high galactic latitudes, suspected by Lundmark and Melotte from an examination of Franklin-Adams plates.

Meteors and Fireballs. A study by Dr. Fisher of the ratio of iron to stone in meteorite falls (*H.B.* 845) yields the result 2.5, which is regarded as an indication of the ratio of iron to stone in the dark matter of interplanetary and interstellar space. The total number of "falls" and "finds" of all sorts was 849 up to the end of 1922, with a total weight of at least 120 tons.

The remarkable shower of fireballs which appeared within a few minutes of 8:00 P.M., E.S.T., on August 10, 1927, was studied by Dr. Fisher. Twenty-six meteors were seen, passing for the most part over southern New England (*H.B.* 851).

The systematic survey of Harvard photographs under the auspices of the J. Lawrence Smith Fund of the National Academy of Sciences has been practically completed, yielding a total of 346 meteor trains (including those previously known on Harvard plates).

Variable Stars. More than seventy notes on variable stars have appeared during the year in Harvard Observatory publications.

Active work has been continued on the program of Milky Way variables, which is partly supported by a grant from the Milton Fund. Several hundred variable stars have been detected (mainly by Miss Swope, Miss Woods, and Miss Gill), for which publication is deferred until the regions under study have been more fully examined.

Fifteen new variable stars have been published, bringing the number of Harvard Variables to 4010. Over a hundred and fifty other new

variables will be announced in *Harvard Bulletins* already in press or in preparation. Seventy-two were found by Dr. Luyten with the blink microscope, and seventy-five by Miss Woods in her systematic examination of plates. The lists include twenty-six long-period variables, two Cepheids, two eclipsing stars, three stars of the R Coronae type, one of the RV Tauri type, and five novae. The new variables represent the work of Professor Gerasimovič, research associate from the University of Kharkow, Miss Harwood, of the Maria Mitchell Observatory, Dr. Luyten, Dr. Paraskevopoulos, Miss Swope, Miss Walton, and Miss Woods.

Eclipsing stars have been studied photographically. Mr. Waterfield has published light curves for V Leporis, UW Virginis, ZZ Sagittarii, Z Normae, DW Sagittarii, and RV Telescopii; Miss Woods has derived the light curve of W Ursae Minoris, and Professor Gerasimovič has obtained light curve and orbit for SX Cassiopeiae. Orbits have been computed by Mrs. Shapley for X Trianguli, V Leporis, FP Carinae, W Ursae Minoris, ZZ Sagittarii, TT Hydrae, and UW Virginis. The last of these stars has a remarkably large range at primary minimum.

Visual data on twelve southern long-period variables have been assembled and discussed by Mr. Campbell. Dr. Shapley and Mr. Waterfield have outlined a scheme for the photographic study of long-period variable stars on Harvard plates, and published light curves for TW and TU Centauri (*H.R.* 41).

Cepheid variables have been the subject of several extensive investigations. The fourth magnitude star β Doradus has been shown to be a normal Cepheid variable (*H.C.* 313). A revision has been made by Dr. Shapley and Miss Roper of the periods of seventy-three Cepheid variables in the cluster Messier 5, and the variables in Messier 22 have been investigated by Miss Swope.

An accurate determination of the median photographic magnitudes of fifty Cepheid variables by Miss Walton has formed the basis of estimates of their distances (*H.B.* 845).

Studies of several individual Cepheid variables of long period have been made by Professor Gerasimovič, and elements and light curves have been derived for SV Vulpeculae, CG Sagittarii (which is at a distance of forty kiloparsecs), SZ Cassiopeiae, and RS Puppis.

The "quasi β Lyrae" type of variable has been studied by Professor Gerasimovič, who published detailed discussions of SS Geminorum, TT and TX Ophiuchi, H.V. 4002, recently discovered by Miss Harwood, and V Vulpeculae. AC Herculis, for which Mr. Waterfield published a light curve, is a star of similar type. This, the first systematic study of a kind of variation that is hard to interpret, may suggest connecting links between variation of the Cepheid and long-period types. The stars RU Aquarii and Z Leonis, examined in the course of his study of semi-regular variables by Professor Gerasimovič, are found to undergo variations hitherto unduplicated.

Changes of period have been found for the eclipsing star SW Lacertae by Mr. Campbell; by Mr. Waterfield for the cluster variable RR Geminorum; and by Professor Gerasimovič for the semi-regular variable V Vulpeculae. Corrected periods have been derived by Mr. Campbell for U Cephei, and by Mr. Waterfield for RZ Librae. Miss Sawyer finds that TX Scorpii is not variable.

Professor Hertzsprung, of Leiden University, during a seven months' visit to the Harvard Observatory, made 11,000 estimates of the magnitudes of short-period variables. His researches bear on the important discovery previously made by him of the systematic relation of form of light curve to period-length among typical Cepheid variables. A peculiar object of very short duration, photographed on a Harvard plate, is described by him in *Harvard Bulletin* 845.

A catalogue of long-period variable stars, begun at Harvard by Professor Townley, of Stanford University, is nearing completion by Mr. Campbell and Miss Cannon, and will soon be published.

In addition to the usual *Harvard Circulars* predicting and summarizing the maxima and minima of long-period variables, a compilation has been published by Mr. Campbell of the observations for 1926 on three irregular variables of the SS Cygni type, four of the R Coronae Borealis type, and R Scuti and R Orionis. The bimonthly predictions for long-period variables, based on the observations of the A.A.V.S.O., have been continued in the *Bulletins* as in previous years.

A hundred observers have sent more than thirty-two thousand observations to the Observatory during the year. The A.A.V.S.O. has been responsible for about eighteen thousand of these, and the French Variable Star Observers for about fourteen thousand. Some other observations have come from individuals, and from other observatories. As in previous years, all the contributed observations have been plotted, entered in ten-day ledgers, and used in deriving the predicted and observed dates of maxima and minima that are published by the Observatory.

Proper Motions. Of the total number of four hundred pairs of old and recent Bache plates taken for proper motion work, 230 had been examined in the blink-microscope before September 30, 1926, and the remaining 180 pairs have now been analyzed. The total number of objects marked by Dr. Luyten on these plates has been brought up to 2500. Allowing for the overlapping of the plates for objects already known, it is expected that from seven hundred to a thousand new proper motions will be measured.

A first list of proper motions found from Bache plates was published as *Harvard Circular* 310. Subsequent surveys of proper motion with the blink-microscope have been confined to plates taken with the 24-inch Bruce telescope. A set of plates taken with this instrument, mainly between 1896 and 1904, showing stars down to the sixteenth magnitude

and covering practically the entire southern sky, will provide excellent material for a proper motion survey of the southern hemisphere as soon as new plates have been taken. Only a small number of suitable pairs are available at present, of which thirty have been examined during the past year; some two thousand proper motion stars, mainly between magnitudes 12 and 16, have been found.

Proper motions of thirty-one stars, found on Bruce plates centered on the Orion Nebula and the Hyades, have been published in *Harvard Circular* 310.

The largest proper motion thus far discovered, 1″.66 annually, is that of a star of magnitude 14.5 in the region of η Carinae (*H.B.* 845). Sixteen new pairs with common proper motion have been measured (*H.B.* 852).

Proper motions of eleven cluster-type variables have been determined from plates in the Harvard collection (*H.B.* 847), and the proper motion of Nova Pictoris has been found to be 0″.05 in 247° (*H.B.* 852).

Star Clusters. A classification based on the degree of central concentration has been devised for globular star clusters, and has been applied by Dr. Shapley and Miss Sawyer to all known globular systems (*H.B.* 849). The angular diameters and integrated photographic magnitudes have been measured on many photographs of several special series (*H.B.* 848, 852), as a preliminary step to the determination of the distances and distribution of globular clusters and the measurement of the size of the Milky Way. The forms and orientations, so far as determined, have also been derived from Harvard plates.

The bright galactic cluster N.G.C. 6231 has been measured for proper motion by Professor Priscilla Fairfield, of Smith College (*H.B.* 843); a general photometric survey, including an estimate of the distance, has been made by Dr. Shapley and Miss Sawyer (*H.B.* 846).

The distance of Messier 22, the brightest and nearest globular cluster visible from northern observatories, has been determined by Dr. Shapley to be twenty-one thousand light years; this value is based on a study of the bright stars, supplemented by new investigations of the cluster-type variables by Miss Swope (*H.B.* 848).

Miss Roper has assisted in a study of the stars in the more distant globular cluster Messier 5; results have been obtained bearing on the uniformity of periods of about fifty variable stars throughout intervals of six thousand maxima (twenty-eight years) (*H.B.* 851), and bearing on the constancy of brightness of presumably non-variable stars. The work, begun at Mount Wilson, has been in progress intermittently for ten years.

Spectroscopic Researches. During the year, 20,091 spectra have been classified, comprising those of 3650 stars from the catalogues of the Astronomische Gesellschaft between +50° and +60°, of 4191 stars at the North Galactic Pole, and of 12,250 stars in the Taurus-Monoceros

regions of the Milky Way. The total number of spectra now classified by Miss Cannon at Harvard is 256,941. The fourth section of the *Henry Draper Extension*, now in press, brings the number of published classifications up to 240,500.

Wave-lengths and identifications for more than five hundred lines in the spectra of γ Cygni and δ Canis Majoris have been derived by Miss Payne and Mr. Chase (*H.C.* 300); all the stronger lines of ionized lanthanum, ionized zirconium, ionized yttrium, and ionized europium are found (*H.B.* 841). A detailed analysis of the spectrum of α Persei, partly based on long dispersion Harvard plates, has been made by Dr. Dunham. Miss Payne finds all the stronger lines of the atom of ionized vanadium present in the solar spectrum (*H.B.* 841).

The spectral changes of seventy of the brighter Cepheid variables have been discussed by Dr. Shapley and Miss Walton. The ranges in spectral class vary between twelve and three spectral subdivisions. The range in spectrum is not apparently related to the median spectral class, nor to the length of period (*H.C.* 313). A strong correlation of median spectral class with length of period is shown. An important application of the result is the standardization of spectral criteria of luminosity for very bright stars.

Several investigators have devoted a large part of their time to the development of spectrophotometric methods. The calibration of plates by the use of standard apertures has been put on a working basis by Miss Payne and Mr. Hogg (*H.C.* 301). Another method of plate standardization by photographing simultaneously several stars of known magnitudes was first applied by them to stars of the same spectral class, notably the brighter Pleiades (*H.C.* 301), but was extended by Mr. Hogg to include stars of all spectral classes (*H.C.* 309), and forms the basis of his program of standard close pairs of bright stars with suitable magnitude intervals, conveniently distributed over the sky. Methods of laboratory calibration were developed by Dr. Dunham (*H.B.* 853). Miss Payne has found the use of standard line depths applicable in some problems.

Spectrophotometric studies of several stars have been published. Miss Payne and Mr. Hogg discuss line depths for the Pleiades, and relate them to the surrounding nebulosity (*H.C.* 303); Dr. Dunham gives preliminary results of a study of stars of Class A (*H.B.* 853); the variations of Mira Ceti were followed by Miss Payne and Mr. Hogg, who find that the emission lines never contribute more than a tenth of a magnitude to the star's light, and the absorption bands divert about twenty per cent (*H.C.* 308).

From a study of forty of the brighter Pleiades, Mr. Hogg derives their temperatures and concludes that the assumption of black-body radiation is satisfactory for all the stars concerned (*H.C.* 309). Miss Payne, in a similar study of seventeen stars near the open cluster N.G.C. 6231 finds that the energy distribution in the spectra of the

Wolf-Rayet stars does not fit satisfactorily with black-body assumptions; if energy-temperatures can be assigned to these stars at all, they are sensibly cooler than normal stars of Class B0 (*H.B.* 845). She proposes to express the energy distribution in stellar spectra in terms of "color magnitudes."

Numerous investigations have dealt with emission lines in stellar spectra. The connection between absorption and emission lines has been discussed by Mr. Davidovich, who notes the tendency of emission to occur at the red end of a series, and distinguishes central emission and emission wings, regarding the latter as indicative of motion in the stellar atmosphere (*H.B.* 846). Miss Payne and Mr. Hogg consider in their study of the Pleiades that the weakening of $H\beta$ as compared with $H\gamma$ is an effect of incipient central emission (*H.C.* 303).

Twelve southern B stars showing unrecorded bright lines have been found by Miss Payne (*H.B.* 846). Professor Gerasimovič adds seven stars to the number already known that have diffuse bright lines of ionized iron (*H.B.* 851).

The southern stars of Class O, both of absorption and Wolf-Rayet type, were completely reobserved with increased dispersion, and their spectra described in detail (*H.B.* 842, 843). Miss Payne has found ten stars hitherto unrecognized as O stars, including one of Wolf-Rayet type, among the early B stars—fewer than was expected. It is possible that Class O could profitably be redefined to include some of the early B stars (*H.B.* 846).

Theoretical Researches. In a study of the distance of the sun from the galactic plane, by Professor Gerasimovič and Dr. Luyten, a value of +33 parsecs, with a mean error not greater than three parsecs, is deduced (*H.R.* 37). The somewhat different results derived by Charlier for the Class B stars, and a determination by him of the coördinates of the center of the system of B stars, are criticized by Dr. Shapley on the ground that Charlier's material is not homogeneous (*H.B.* 846).

From an investigation of the luminosities of stars of Class B3, Professor Gerasimovič concludes that stars showing emission lines are distinctly brighter than those that have only absorption lines. The conclusion is quantitatively supported by data, on all classes from O to B5, taken from moving clusters. Thus it appears that among the B stars the higher luminosities are associated with the lower temperatures, a result recalling the decrease of temperature in passing from dwarf to giant among the cooler stars (*H.B.* 849).

The observed period-spectrum relation for galactic Cepheid variables is shown by Dr. Shapley to lead directly to a period-luminosity curve that is in very close agreement with the period-luminosity curves derived from clusters and star clouds.

The cluster-type variables do not show a change of median absolute magnitude, color index, or spectral class with period. The interpreta-

tion of this fact cannot involve differences in mean density and dimensions, or in mass. Dr. Shapley suggests (*H.C.* 315) that the anomaly is connected with important nuclear changes in the stars, associated perhaps with the critical position of the cluster variables in the spectral series, between the giants and the main sequence.

For the Saha formula giving the degree of ionization in a stellar atmosphere, Professor Gerasimovič has evaluated the correction that must be applied for small deviations from thermodynamic equilibrium; the correction is of importance in the uppermost photospheric layers, and for stars with extended atmospheres its effects may be considerable (*H.R.* 36). The alternative formula suggested by Pannekoek would be considerably modified if a different functional relation were assumed between the probability of ionization and the frequency (*H.B.* 841).

Professor Gerasimovič has adapted the theory of ionization to the analysis of nebular conditions, discussing a planetary nebula with a hot central star. The electron temperature, which is a function only of the optical thickness of the nebular gas and of the temperature of the star, may be between 2000° and 25,000°. Stars cooler than Class B2 cannot form the nuclei of planetaries. An enhanced bright-line spectrum cannot be formed around a star of Class Md if the envelope is in a steady state—a result with applications in the spectroscopic interpretation of long-period variables (*H.R.* 38).

It is shown by Professor Gerasimovič that the ionizing effect of penetrating radiation on stellar atmospheres must in general be negligible. Within diffuse nebulae, however, and in the atmospheres of supergiant M stars, conditions are favorable to the formation of relatively strong local fields of penetrating radiation and the ionizing effect may then be sensible (*H.R.* 39).

Dr. Fisher has been led by the noticeable area of shower radiants, the straightness of meteor paths, the observed orientation of meteorites, and the flicker often observed and photographed for meteors, to an interpretation in terms of the dynamics of a spinning projectile moving in a resisting medium.

Miscellaneous. Professor King and Miss Harwood have completed a detailed photometric study of the distribution of light in the corona, photographed at the total solar eclipse of January 24, 1925, at the Maria Mitchell Observatory, Nantucket (*H.C.* 312).

From a photometric study of a number of bright stars, Professor King concludes that a local cloud of absorbing matter may be responsible for the preferential reddening of stars that are nearer than a hundred light years (*H.C.* 299).

Dr. Paraskevopoulos has measured the integrated brightness of the Small Magellanic Cloud, photographing it out of focus with lenses an inch or less in aperture. The integrated apparent magnitude is +2.3, corresponding to an absolute photographic magnitude of —15.7.

The publications of the Observatory during the year comprised twenty *Circulars*, eleven *Bulletins* containing 120 contributions, and ten *Reprints* from various scientific periodicals. Twenty-five *Announcement Cards* were issued.

During the year 3600 plates were made with the telescopes at Cambridge, under the general direction of Professor King, and 450 plates were made at Arequipa and Bloemfontein.

HARLOW SHAPLEY, *Director.*

UNITED STATES NAVAL OBSERVATORY

WASHINGTON, D. C.

Changes in the staff. Material Department (Naval): CAPTAIN W. C. ASSERSON, U.S.N., and COMMANDER W. H. LEE, U.S.N., detached. Astronomical Department, ASTRONOMER JAMES ROBERTSON, Assistant Director of the Nautical Almanac, made a member of the Astronomical Council; JUNIOR LIBRARIAN G. C. RODGER, JUNIOR ASTRONOMERS W. M. BROWNE and J. D. PHENIX appointed; ASSOCIATE ASTRONOMER E. C. BOWER, and JUNIOR ASTRONOMER W. C. MYERS, resigned; ASSOCIATE ASTRONOMER A. NEWTON, died 25 Jan. 1927.

The activities of the Naval Observatory which are of no particular interest to astronomers will be omitted except to state that:

The stock of navigational, surveying, and aeronautical instruments on hand is now valued at $931,354.86, much of the stock having been transferred elsewhere for storage. The Nautical Instrument Repair Shop made repairs to 4050 instruments at a total cost of $30,364.50.

The Naval Observatory has continued to furnish official "time" to the greater part of the United States. On August 1, 1927, additional short-wave time signals, via Arlington, were begun, on 24.9 and 37.4 meters. With those and the continuing time signals on 74.7, 435, 2650, 9810, and 17,145 meters, no one should be at loss for the "correct time."

A "Zero Mark," giving the latitude, longitude, and altitude above sea level, of the Naval Observatory, has been installed on the "Meridian of Washington" in the center of the clock house, which is the reference point of the Observatory.

The Naval Observatory exhibit at the Sesquicentennial Exposition at Philadelphia was awarded a gold medal.

World Longitude Work. Observations were made in October and November at the U. S. Naval Observatory, Washington, D. C., and at the Naval Air Station, San Diego, California. The preliminary calculations show gratifying results. Using these results in connection with those obtained at Greenwich and Paris by the observers there, the following preliminary results have been obtained:

	h	m	s	s
Washington - Greenwich	5	8	15.753	± 0.002
Washington - Paris	5	17	36.659	± 0.003
San Diego - Washington	2	40	32.627	± 0.002

Velocity of Radio Transmission (Washington-San Diego) 179,000 ± 14,000 miles per second.

Nautical Almanac Office. The American Ephemeris and Nautical Almanac for 1929 was received from the printer on May 14, 1927, and *The American Nautical Almanac for 1929* on May 26, 1927.

All the copy of *The American Ephemeris and Nautical Almanac for 1930,* except 67 pages, has been sent to the printer, and 407 pages are in type.

The investigation of the orbits of Saturn's satellites has been continued. One hundred and seventy-eight sets of corrections to the elements have been obtained from 18 pairs of satellites, and the equations of condition have been found for 17 more sets, covering in all 22 oppositions. There have been received during the year in manuscript, through the kindness of Director E. B. Frost, of the Yerkes Observatory, the results of Professor Barnard's observations during the years 1917-1922.

Work has been commenced on a new Zodiacal catalogue to contain over 3000 stars, including all those in Hedrick's *Catalogue of Zodiacal Stars,* and Gill's *Catalogue of 2798 Zodiacal Stars.*

Vol. IX, Part III, *Astronomical Papers of the American Ephemeris: The Orbit of Neptune's Satellites and the Pole of Neptune's Equator,* was received from the printer on May 15, 1927.

The Almanac Office lost by death on January 25, 1927, one of its most valuable assistants, Associate Astronomer Arthur Newton, who had been connected with the office since 1904.

Photographic Zenith Tube. The number of observations secured during the year was 1850. The publication of the results for 1926 has been delayed by the participation of the astronomer in charge of this instrument in the world longitude observations at San Diego, California.

Equatorials. With the 26-inch equatorial, observations were made as follows: occultations, 25; eclipses of Jupiter's satellites, 5; comet 1926 *f* (Comas Solá), 4; comet 1927 *c* (Pons-Winnecke), 8; comet 1927 *d* (Stearns), 7; satellites of Mars, 95; satellites of Jupiter, 3; satellites of Saturn, 38; instrumental constants, 3; parallels, 98; coincidences, 20.

The screw of the Repsold micrometer was examined. The errors remain negligible.

Four new bevel gears and two driving rods were bought for the 26-inch, to take the place of the gears and rods which go from the driving clock to the worm screw moving the large driving wheel centered on the polar axis.

With the 12-inch equatorial, observations were made as follows: occultations, 17; eclipses of Jupiter's satellites, 3; instrumental constants, 2.

A friction drag was mounted on the 12-inch driving clock, to control

the conical pendulum, taking the place of the brake-shoe control.

The equatorial volume comprising observations from 1908 to 1926 is ready to go to the printer. Besides observations with the 26-inch and 12-inch equatorials, it includes observations with the photographic equatorial on asteroids from 1912 to 1924 and the photoheliograph sun plates from 1921 to 1926, and discussions of a number of series of satellite observations: namely, those of Mars, Saturn, Uranus, and Neptune.

Photoheliograph. Observations of the sun were made on 247 days. Solar spots or groups were observed on 244 of these days. Several enormous spots have appeared during the year.

The current solar photographs have been measured for area and position of spots.

Exchange of data with the Western Union Telegraph Company has been continued, and since January, 1927, the current observations have been published in the *Monthly Weather Review.*

6-inch Transit Circle and Prin Transit. With the 6-inch transit circle 3749 observations were secured including those of the sun, moon, planets, and stars. With the Prin transit 477 observations were secured, including clock and azimuth stars.

With the Prin transit observations were made for use in the world longitude work.

With the 6-inch transit, in addition to its regular work, observations were made on a special list of stars for use in the Eros solar parallax work of 1930-31.

Volume XI, containing a discussion of about 50,000 observations made from 1909 to 1918, and a catalogue of fundamental stars, including those of Backlund and Hough for the equinox 1910.0, is nearly through the press.

Clock Vault and Clocks. The temperature of the clock vault was maintained practically constant at 84° F during the year. Riefler No. 60 was used as the standard clock. The total variation in daily rate during the year was No. 60, $0^s.08$; No. 70, $0^s.10$; No. 151, $0^s.22$.

9-inch Transit Circle. Work has progressed on the reduction of the 72,330 observations secured from 1913 to 1926. Instrumental constants and clock corrections are all reduced. The apparent places are reduced as far as 1922 and the mean places as far as 1919.

Prime Vertical Transit. Work has been continued on the reduction of observations secured with this instrument.

Volume X, comprising the results of observations with this instrument from 1893 to 1912 was received from the printer in July, 1926.

The Library. The Library contains 40,213 volumes and pamphlets, 937 having been added during the year.

EDWIN T. POLLOCK, CAPTAIN U. S. N., *Superintendent.*

PERKINS OBSERVATORY

OHIO WESLEYAN UNIVERSITY

DELAWARE, OHIO

With the aid of one of the Common Mirrors which has been loaned to us by the Harvard College Observatory we have been able to use the mounting of the 61-inch reflector for the instruction of students and of the public. The work of producing a satisfactory disk for the speculum of the reflector has been in progress at the Bureau of Standards during the year. The undergraduate classes were large for a university of the size of Ohio Wesleyan. Graduate work was also given. The Observatory was opened to the public one night each week. The number of visitors from January 1 to October 1, 1927, totaled 12,635. No research other than that connected with a study of the mounting of the reflector was undertaken.

Mr. Ernest Clare Bower was appointed an Assistant Professor to fill the vacancy caused by the resignation of Mr. Lloyd Wylie.

CLIFFORD C. CRUMP, *Director.*

PRINCETON UNIVERSITY OBSERVATORY

PRINCETON, NEW JERSEY

Personnel. Messrs. Theodore Dunham, Jr., Arthur S. Fairley, and Michel Kovalenko received their Ph.D. degrees. Dr. Dunham went to Mt. Wilson Observatory as a National Research Fellow; Dr. Fairley to Central College, Missouri, as Professor of astronomy and Director of the Morrison Observatory; and Dr. Kovalenko to Swarthmore College as Assistant Professor of mathematics.

Theoretical Researches. Mr. Russell has been engaged mainly in spectroscopic investigations. A detailed analysis of the arc and spark spectra of scandium, classifying about 500 lines, has been completed, in collaboration with Dr. Meggers, and published as a Scientific Paper of the Bureau of Standards. Certain points connected with Hund's theory of spectral structure have been discussed in the *Physical Review.* Other extensive spectroscopic investigations by Mr. Russell are summarized in the Mt. Wilson report.

Mr. Stewart, through the generosity of the Palmer Physical Laboratory, secured rooms there for experimental study of problems of astronomical physics. Mr. Fairley began observations of sodium absorption lines, which are being continued by Mr. Korff.

Observational Researches. The observation of eclipsing variables was continued with the polarizing photometer on the 23-inch telescope. The old Nicol prism having suffered injury, a new one was purchased, and adjusted in February, 1927. The following stars were observed,

some of them much, others little: RT And, TW And, TZ Boo, SZ Cas, XX Cas, Y Cyg, SX Gem, RX Hya, TY Peg, RT Per, SV Tau, W UMa, TY Vir, UW Vir, RR Vul, BD +75°752. The total number of settings is about 15,000, two-thirds of them having been made by Mr. Dugan, and the rest by Messrs. Fairley, Kovalenko, and Dunham.

H. N. RUSSELL, *Director.*

ASTROPHYSICAL OBSERVATORY

SMITHSONIAN INSTITUTION

WASHINGTON, D. C.

Personnel. The Observatory operates two field stations: Mount Montezuma, near Calama, Chile—director, H. B. Freeman; assistant, E. E. Warner; Table Mountain, California—director, A. F. Moore; assistant, H. H. Zodtner; and in addition a third station at Mount Brukkaros, South West Africa, financed by a grant from the National Geographic Society—director, W. H. Hoover; assistant, F. A. Greeley. At the headquarters in Washington where computing, publication, and preparation of instruments are attended to—director, C. G. Abbot; research assistants, F. E. Fowle and L. B. Aldrich; computers, Mrs. A. M. Bond and Miss Margaret Marsden; instrument maker, A. Kramer.

Work of the Year. The three stations above mentioned are maintained for the daily observation of solar variation.

Results from the Mount Montezuma station are now definitive, the general revision for the purpose of improving the accuracy of the results by statistical treatment having been completed. At both the Table Mountain and the Mount Brukkaros stations a long series of the basic long-method observations has been obtained, and the preparation of the short-method tables has progressed rapidly during the year.

Daily reports of the solar-constant values from the Mount Montezuma station have been published by the Weather Bureau as a feature of the daily weather map.

A second trial of the new method of testing solar variation mentioned in last year's report was undertaken with the Mount Montezuma observations from 1920 to 1926. A paper by Dr. Abbot, describing the excellent success of this work, was published in *Smithsonian Miscellaneous Collections,* Vol. 80, No. 2. Also, with the aid of Dr. Dayton C. Miller, these Mount Montezuma values were harmonically analysed. This analysis brings out quite strongly a periodicity of 25⅔ months, which, if confirmed by future observations, will open up possibilities in long range weather forecasting. This analysis, together with other interesting evidences of solar variability, is described in detail in the above-mentioned paper by Dr. Abbot.

H. W. DORSEY, for C. G. ABBOT.

SPROUL OBSERVATORY

SWARTHMORE COLLEGE

SWARTHMORE, PENNSYLVANIA

The 24-inch refractor is used chiefly in furthering the parallax program. 420 plates were made during the year. This work was in charge of Mr. Pitman. He was assisted by Mr. McLaughlin, Miss Williams, Mr. Matos, and Mr. Wasser. Mr. Pitman and Mrs. Battin measured the necessary plates and computed the parallaxes of 15 stars. Mr. Miller and Mr. Marriott measured some of the plates taken to test the Einstein deflection of light theory. The measures are now being reduced.

Mr. McLaughlin, using the 9-inch quadruplet, continued his work in photographic photometry of variable stars.

The volume of work accomplished is seriously affected because the members of the staff carry rather heavy teaching rosters.

JOHN A. MILLER, *Director.*

OBSERVATORIO ASTRONOMICO NACIONAL

TACUBAYA, MEXICO

Owing to the small number of the staff it has been difficult to carry out the program.

The computations of constants of the plates of the *Astrographic Catalogue* have been carried on by the two computers. All the results of zones —13°, —14°, and —16° are ready for publication. The remeasurement of zone —12° is nearly finished. The volume containing zone —15° will be issued at the end of the year, and the printing of another will be begun.

Magnetic observations have been continued during the year. Bulletins containing the results will be published. The new magnetometer, of the Carnegie Institution type, is in operation.

Mention should be made of the independence of the Observatory, which, since 1915, has been a department of Dirección de Estudios Geográficos y Climatológicos. It is now directly responsible to the Minister of Agriculture.

The completion of the publication of the "Carte du Ciel," and of the meridian observations of zone stars, as well as the reorganization of the program of work for next year, will depend on the financial condition of the Observatory.

JOAQUIN GALLO, *Director.*

VAN VLECK OBSERVATORY

WESLEYAN UNIVERSITY

MIDDLETOWN, CONNECTICUT

The 20-inch refractor has, as usual, been devoted primarily to the securing of photographs for the determination of stellar parallaxes. For this purpose 606 plates were taken on 135 nights. For other purposes 154 plates were made. Of these, 82 were photographs of the sun and 42 were for the study of atmospheric dispersion.

On March 10, Dr. Stearns discovered a comet near BD —7°4003, one of the stars on our parallax program. Photographs of this comet have been made with a 4-inch doublet on 29 nights.

Professors Slocum and Sitterly went to Aal, Norway, for the total eclipse of the sun of June 29, 1927. Four cameras, two of 3-inch and two of 3½-inch, and all of about 12 feet focal length, were mounted on a heavy polar axis. Exposures ranging from 2 to 28 seconds were to be made for the study of the structure of the corona. Standard squares were to be impressed on all plates for photometric study. A King pin-hole photometer and several small cameras were also to be used. The sky was totally cloudy and no results were obtained.

Professors Slocum and Sitterly have, as in previous years, shared in the teaching, giving four year courses and one half-year course. Dr. Stearns has devoted all his time to the research program.

FREDERICK SLOCUM, *Director.*

WASHBURN OBSERVATORY

UNIVERSITY OF WISCONSIN

MADISON, WISCONSIN

Miss Doris Evans, secretary and computer, left after four years of service, during which she performed most of the secretarial work of the American Astronomical Society.

The new mounting for Burnham's 6-inch refractor was finished in the University shops. This mounting will be adapted to carry a 10-inch photographic objective which has been received from J. W. Fecker.

A new photo-electric photometer with a Lindemann electrometer has been completed and is in active use. This instrument is fully as sensitive as the old one with the swinging string electrometer, and is more convenient and rapid in operation.

The 15-inch refractor was used on eighty-two nights for the regular program of photo-electric photometry, including observations of spectroscopic binaries and red stars. Of one hundred red stars tested more than one-third have been found variable to the extent of a tenth of a magnitude or more within an interval of from two weeks to two

months. All red stars tested which are of absolute magnitude —1.0 or brighter show variation; while nearly all stars of spectral classes M4, M5, and M6 are likewise variable. Either extreme brightness or extreme redness seems to be a criterion for variability.

The printer's copy was completed for Volume 15, Parts 1 and 2, of the *Publications of the Washburn Observatory,* which is now going though the press. The publication contains the results of photo-electric photometry carried on for ten years at Urbana and Madison.

In August and September, 1926, Mr. Stebbins spent some weeks at Mount Hamilton, and observed the light of Jupiter's satellites for a test of the solar variation. The results have been published as a *Lick Observatory Bulletin.*

JOEL STEBBINS, *Director.*

YALE UNIVERSITY OBSERVATORY

NEW HAVEN, CONNECTICUT

Personnel. Dr. Jan Schilt, of the Leiden Observatory, was appointed Research Assistant with the rank of Instructor, beginning September 1, 1926. Mr. Schlesinger sailed for England on February 12, and delivered the first George Darwin Lecture before the Royal Astronomical Society on March 11. He returned to New Haven on March 27. During these six weeks Mr. Brown acted as Director.

Activities. Continuing our experiments with fields of very large angular extent, six plates with centers at declination 35° were secured with the Catalogue Camera. They were measured by Miss Barney, and thoroughly discussed by her and Mr. Schlesinger. These plates give satisfactory results. They show that positions can be obtained with their aid that are about as accurate as those derived from the smaller fields upon which the results in Volumes 4 and 5 of our *Transactions* are based. It is necessary to apply some empirical terms, but their presence does not detract from the accuracy of the final positions. It is highly probable that a more extensive piece of work with this camera will throw more light upon the origin and nature of these terms. We have accordingly decided to derive in this way the positions of all the Astronomische Gesellschaft stars in the two zones from 20° to 25° and 25° to 30°. These two together comprise about 22,000 stars. Each plate extends one hour in right ascension and ten degrees in declination. The work of preparing the observing list and other preliminaries to this task is well under way. The Lick Observatory has continued the generous coöperation that applies to the two zones we have already published and is observing for us the positions of about 1080 comparison stars in this zone.

In the two catalogues that we have already issued (—2° to +2° and +50° to +55°) are given the proper motions of practically all the

15,467 stars that they contain. A study of these results by Mr. Schilt, Miss Barney, and Mr. Schlesinger has led to important conclusions, and incidentally has emphasized to us the need of knowing more about the spectra and magnitudes of these stars. At our request, Director Shapley and Miss Cannon, of Harvard College Observatory, have kindly agreed to determine the type of spectra for all the Gesellschaft stars not already in the Draper Catalogue. The best information at present forthcoming regarding the magnitudes of the fainter stars in these zones is the result of eye estimations made by meridian observers at the time the original Gesellschaft Zone Catalogues were compiled. To obtain better information of this kind, Mr. Schilt is securing plates here and is measuring them by the thermo-electric method which he did so much to develop at the Leiden Observatory.

At the end of the preceding year Miss Barney had measured about one-third of the plates in the zone 55° to 60° secured under Mr. Schlesinger's direction at the Allegheny Observatory in 1915 to 1917. In February, 1927, she completed these measures. The computations on them have been carried as far as possible. The completion of this work awaits the comparison positions which are very kindly being secured for us by Dr. Hins with the meridian circle of the Leiden Observatory. It is expected that these positions will be forthcoming early in 1928 and that our catalogue will be completed by June, 1928. There will be approximately 8300 stars in this work. This number includes about 500 stars not in the Gesellschaft catalogues which we inserted to fill gaps in the latter so as to permit the reduction of astrographic plates or any other plates of about this size that fall within the zone. It is our intention to supplement in this way the Gesellschaft stars in other zones wherever it is desirable to do so.

Miscellaneous. Miss Pond has kept up to date the card catalogue of stellar parallaxes. This includes determinations by the trigonometric, spectroscopic, dynamic, and all other reliable methods. She has prepared for the printer the tabular matter for Parts I and II of Volume 6. Miss Gesler has prepared a complete card catalogue of radial velocities. Both of these card catalogues are not only used extensively by us but are put at the disposal of other astronomers who express a desire for this information. In one such case we have furnished information concerning the parallaxes of a list of about 2000 stars.

Mr. E. W. Brown has been engaged on a treatise on Celestial Mechanics which he is preparing in conjunction with Mr. C. A. Shook, of the Department of Mathematics. The treatise has involved a number of minor investigations designed to improve the ease of computing the orbits of planets and to render the exposition of the theory more simple. He has also been engaged in a campaign to obtain the observation and reduction of occultations of the moon and has enlisted the valuable services of a number of amateur astronomers who are members of the

American Association of Variable Star Observers. This campaign is designed to obtain a more accurate idea of the difference between the observational and gravitational positions of the moon in connection with his work, which appeared to show that this difference was due to changes in the rate of rotation of the earth.

The engine mentioned in the report for last year, intended for measuring parallax plates at our Southern Station, has been completed and shipped to Johannesburg. Under Mr. Schilt's supervision, Mr. Reading constructed a Schilt Thermo-electric Photometer capable of accommodating any plates up to the very large ones (19x23 inches) that we have been securing with our Catalogue Camera. The construction of this photometer was made possible by a grant of $500 from the Gould Fund of the National Academy of Sciences.

Mr. Schilt, from a study of the proper motions in the zone —2° to +2°, with the collaboration of Miss Barney, has found strong evidence of a systematic drift of giant stars with respect to other bodies in our system. Lindblad has recently suggested that certain observed phenomena in stellar statistics could be explained by a rotation of our galaxy. Oort, of the Leiden Observatory, has found confirmation of this suggestion in a discussion of the radial velocities of distant objects. Mr. Schilt, from a study of the data in the zone 35° to 40°, also finds a confirmation of this suggestion in the character of the proper motions. He has also continued his work on stars of the W Ursae Majoris type and has shown that the extraordinarily broad lines in their spectra cannot be accounted for as an effect of rotation but are more likely to be due to a state of fission. He also calls attention to a remarkable correlation between the periods of these stars and their spectral types.

Mr. Slavenas, Fellow of the International Education Board, has published in the *Proceedings of the National Academy of Sciences "A Possible Way to Discuss the Fundamental Principles of Relativity."*

As was anticipated, the reobservation of the Gesellschaft Zones and the resulting proper motions are proving rich mines of information concerning stellar motions and distribution. In addition to the results already mentioned in this report, Mr. Schlesinger has found numerous cases in which these stars exhibit nearly parallel motions and therefore probably constitute moving clusters like the well-known one in Taurus. A very brief report on this subject is included in his George Darwin Lecture. A more complete study awaits data concerning the spectra of more of the faint stars in these zones.

The Southern Telescope. Mr. Alden, in charge of the 26-inch telescope at Johannesburg, reports that 4557 usable parallax plates were obtained during the year. This is about twice as many as are obtained with the very similar telescope at Allegheny Observatory and is far in excess of the number obtained at any other observatory that is engaged in parallax determinations. During the year 150 nights are listed as clear, 135 partly cloudy and 80 altogether cloudy, indicating

that the sky was clear 60 per cent of the time. If this percentage should be maintained the station is better in this respect than we had expected. Rain or hail fell on 99 days.

In addition to the parallax plates, 46 plates of Saturn's satellites were secured and were measured by Mr. Alden and Mr. O'Connell with the stereocomparator at the Union Observatory in Johannesburg. The results are in press; they show a considerable advance in accuracy over the visual measures that have hitherto been employed for this purpose. It is our intention to make a similar series every year as long as Saturn remains south of the equator. A similar plate was secured of Jupiter's satellites, the first of a series that will be obtained in accordance with a request of Professor de Sitter of the Leiden Observatory. At the request of the same institution Mr. Alden has begun a series of photographs of faint Cepheid variables for the purpose of ascertaining the proper motions of these important stars. Nine such plates were secured during the year. We have also agreed, on request of the Committee on Selected Areas, to obtain photographs of such of these regions as lie far south of the equator; 70 of these were obtained by the close of the year. Finally, twelve plates of Pons-Winnecke's Comet and three of the Cluster Omega Centauri were secured.

About sixty parallax plates, forwarded from Johannesburg, have been measured at New Haven for the purpose of determining the accuracy. The results are very satisfactory and indicate a probable error of about 0.023 seconds of arc for a good plate containing three exposures. Mr. Alden's measurements on the plates of Saturn's satellites give an even more favorable indication of the accuracy to be expected.

FRANK SCHLESINGER, *Director.*

(To be continued.)

HEAVENLY ZOO.

Dog-Stars.

Canis Minor.

This little puppy of Orion
Comes, carrying the star, Procyon,
To tell the world a big event:
He scampers in the Hunter's track
And barks that right behind his back
The Great Dog hurries on the scent.

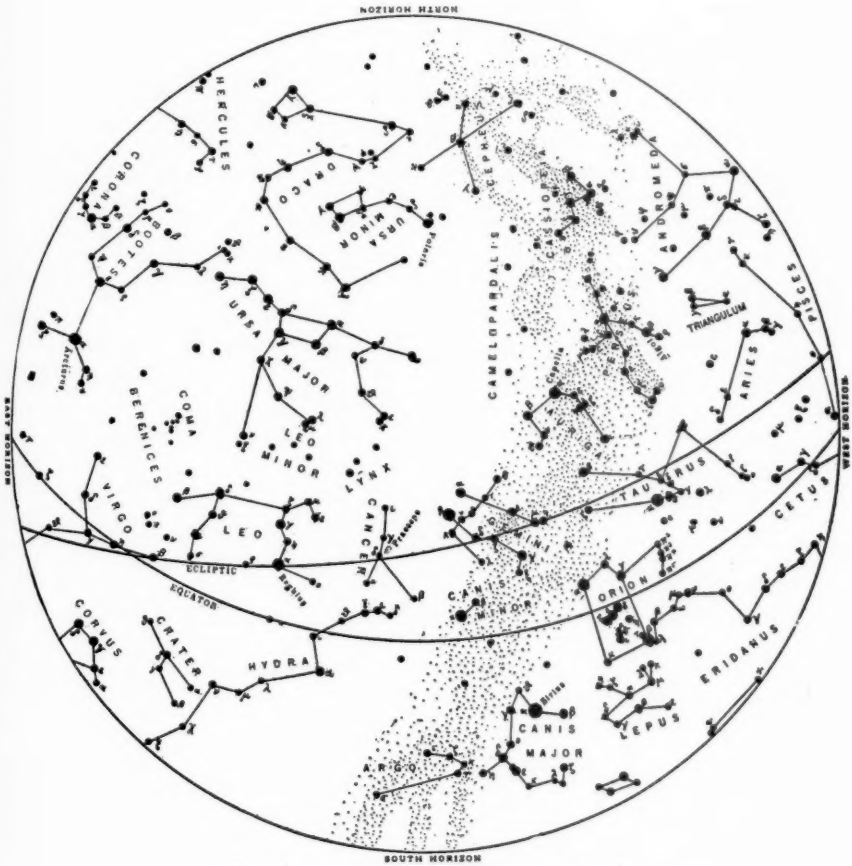
Canis Major.

All through the winter's night and snow
Orion's hound at heel must go.
Yet he of August days is czar:
His jaws are proud with incubus
Of that famed jewel, Sirius,
Earth's brightest, and near-neighbor star.

1490 Stuart St., Denver, Colorado. LILLIAN WHITE SPENCER.

PLANET NOTES FOR MARCH.

By CLIFFORD E. SMITH.



THE CONSTELLATIONS AT 9:00 P.M. MARCH 1.

The *Sun* will be moving northeast from the eastern edge of Aquarius to the central part of Pisces. Late on March 20, G.C.T., it will cross the equator, which marks the beginning of spring. The position of the sun on March 1 and March 31, respectively, will be: R.A. $22^h\,47^m$, Decl. $-7°\,45'$; R.A. $0^h\,37^m$, Decl. $+3°\,59'$.

The phases of the *Moon* will occur as follows:

Full Moon	March	6 at	5 A.M.	C.S.T.
Last Quarter		14 "	9 A.M.	"
New Moon		21 "	2 P.M.	"
First Quarter		28 "	6 A.M.	"

The moon will be at apogee (farthest from the earth) on March 11, and at perigee (nearest the earth) on March 23.

Mercury will be in Aquarius. During most of the month its apparent motion will be eastward, but during the first week of the month its apparent motion will be westward. On March 17 Mercury will be in conjunction with Venus. At that time the angular distance between the two planets will be only thirty-six minutes of arc (a little more than the diameter of the moon). On March 22 Mercury will be at greatest elongation west. On this date it will rise about an hour and a half before the sun. Mercury will pass through aphelion on March 25.

Venus will be moving eastward from the central part of Capricornus to the eastern edge of Aquarius. At the time of conjunction with Mercury, the two planets will rise approximately an hour and a half before the sun. On March 30 Venus will be at aphelion.

Mars will be moving eastward in Capricornus, practically crossing the constellation in the month. It will be a morning object. At the end of the month it will rise about two hours and a half before the sun.

Jupiter will be in Pisces. Its apparent position will be near the sun, and conjunction will occur in April.

Saturn will be a morning object in Ophiuchus. On March 9 it will be in quadrature west of the sun. At that time it will rise approximately at midnight.

Uranus will be in Pisces near the sun. On March 24 it will be in conjunction with the sun.

Neptune will continue to be in Leo near Regulus (α Leonis). At this time of the year it will be in a position for evening observation. Near the end of the month it will be on the meridian about 10:00 P.M. Standard Time.

Occultations Visible at Washington.

[From the *American Ephemeris.*]

Date 1928	Star's Name	Magnitude	IMMERSION. Washington C.T.	IMMERSION. Angle from N	EMERSION. Washington C.T.	EMERSION. Angle from N	Duration
			h m	°	h m	°	h m
Mar. 1	52 B.Geminorum	6.5	2 0	88	2 53	286	0 53
5	42 Leonis	6.1	2 32	70	3 15	350	0 43
6	ν Virginis	4.2	18 32	141	19 25	264	0 53
8	65 Virginis	6.0	23 49	133	1 10	302	1 22
9	66 Virginis	5.7	0 52	134	2 18	302	1 25
9	623 B.Virginis	6.5	21 30	104	22 32	316	1 03
10	96 Virginis	6.5	1 30	177	2 25	257	0 54
10	μ Librae	5.4	22 4	168	22 44	248	0 39
15	67 B.Sagittarii	6.4	3 20	37	3 52	349	0 32
16	201 B.Sagittarii	5.9	2 39	119	3 41	254	1 2
28	52 Geminorum	6.1	22 0	84	23 5	300	1 5
29	35 B.Cancri	6.4	22 26	150	23 20	248	0 54

COMET NOTES.

By G. VAN BIESBROECK.

COMET 1927 *k* (SKJELLERUP-MARISTANY). Very little additional information has been obtained on this short-lived comet. There are few records in cometary history of brilliant comets that were so badly placed for observation. It has been shown theoretically that the geometric conditions of visibility of a comet can be such that its observation is impossible. In the present case the situation was very close to this ideal case and if it had not been for the extraordinary brilliancy of the object, it might easily have evaded observation in its rapid course around the sun.

It appears now that the observation of December 6 at La Plata (Argentina) by Maristany was an independent naked eye discovery. Also on December 16 the comet was noticed in full daylight by H. Wörner at Hanover (Germany) without any knowledge of its previous discovery. No one in the northern hemisphere succeeded in getting micrometric measures since the object could not be seen on a dark sky, which would have shown known stars in the vicinity of the comet. The best that could be done was to get circle readings, instrumental corrections being applied as well as possible. To the previous list of such determinations the following should be added:

Date	α h m s	δ ° ′	Observer	Place	Mag.
1927 Dec. 17.626	17 40 22	—16 15.1	Graff	Hamburg	—1½
18.617	17 43 8	—14 5.1	Graff	Hamburg	—1½
19.673	17 45 32	—12 35	Hoffmeister	Sonneberg	+1
20.150	17 47 11	—11 45.0	G. Struve	Babelsberg	
21.135	17 49 55	—11 25.5	G. Struve	Babelsberg	+2.8
24.532	17 53 50	—11 48.0	Van Biesbroeck	Wms. Bay	+3

My previous readings in declination (see p. 68) for December 20 and 21 should have been —11° 49′.5, 37′.7, and 26′.8 instead of —11° 42′.2, 26′.8, and 19′.3, respectively, as given first.

A cloudy spell after December 24 put an end to the visibility here. At the Whitin Observatory, J. C. Duncan had two later readings:

Dec. 25.492	$17^h\,57^m$	—12°.1	Much fainter!
Dec. 27.475	18 0	—13.0	

but aside from these rough places no further positions seem to have been obtained. I tried to find the object again on January 1 and 2, but the comet was not seen any more on the bright morning sky. It had evidently lost considerably in brightness and in the absence of any ephemeris the extrapolated position was quite uncertain. In order to determine the future course, I used the three morning observations, December 19, 22, and 24, at Williams Bay for computing an orbit with the result:

ELEMENTS

$$\begin{aligned} T &= 1927\ \text{Dec. } 18.360\ \text{U.T.} \\ \omega &= 48°\ 38' \\ \Omega &= 77\ \ 12 \quad (1927.0) \\ i &= 84\ \ 48 \\ q &= 0.1793 \end{aligned}$$

EPHEMERIS

1928 0^h U.T.	α h m	δ ° ′	M
Jan. 7	18 15.8	−17 40	4.1
15	27.5	−20 32	4.9
23	38.2	−22 57	5.5
31	18 47.9	−25 3	5.9

Although quite crude these elements are very much nearer the truth than the previous attempts at the orbit. We see that the position stays almost hopeless through January and that by February, when the angular separation from the sun will become somewhat more favorable for southern observers the brightness will have dropped very much. The tentative figure given in the last column was obtained by assuming a magnitude zero at the time of perihelion. It is now quite evident that in spite of the similarity of the plane of the orbit, defined by elements i and Ω, there is no identity between this comet and the long expected De Vico Comet 1846 IV for which the following elements were obtained by Hepperger:

$$\left.\begin{aligned} \omega &= 12^\circ\ 54'\ \ 5'' \\ \Omega &= 78\ \ 41\ \ 3 \\ i &= 85\ \ 6\ 31 \end{aligned}\right\} (1927.0)$$

$T = 1846$ Mar. 5.552 M.T. Paris
$q = 0.663798$
$e = 0.96291$
Period $= 75.7$ years

For this comet the perihelion distance is nearly four times as large as the value obtained for the recent visitor.

At the December meeting of the Astronomical Society at New Haven, V. M. Slipher presented some details concerning his spectroscopic observations near the time of maximum brilliancy. When examined at first on December 16, the spectrum appeared continuous, being due mainly to reflected sunlight. The same result was obtained by Graff at Hamburg on that day. But as the comet approached perihelion a remarkable change took place, and strong sodium emission D lines appeared in the spectrum of the nucleus as well as in that of the tail. From the shifted position of these lines, Slipher concluded a radial velocity of +93 km/sec. The above orbit indicates a velocity of +96 km/sec at the time of the perihelion December 18.36, which is quite a satisfactory agreement.

The year 1928 has started with a number of faint comets under observation:

In the evening sky COMET 1927 *h* (PERIODIC ENCKE) has brightened up so that on January 21 it was easily visible in a 3-inch telescope. It showed a sharp nucleus with a broad tail some 5′ long in a westward direction, the total light corresponding to a star of the eighth magnitude. Figure 1 shows the appearance on a plate exposed by the writer on that night with the use of the 24-inch reflector. The comet will brighten up more until the beginning of February, after which it will be lost in the glare of the daylight, as can be seen from the following ephemeris, taken from the *Handbook of the British Astronomical Association* for 1928:

1928 0^h U.T.	α h m	δ ° ′
Feb. 3	22 52.6	+ 1 38.0
11	22 34.6	− 3 16.0
19	21 50.6	−13 18.8
27	21 18.5	−20 47.2

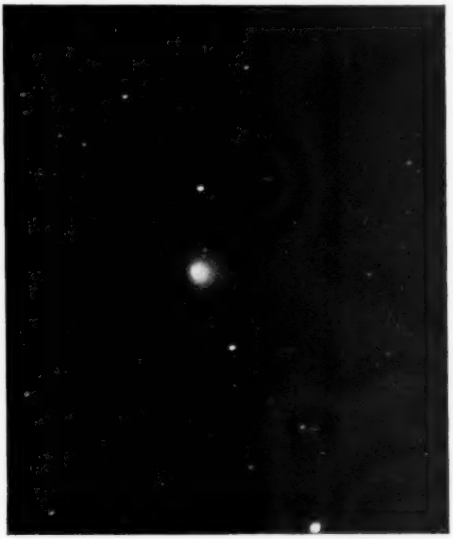


FIGURE 1
COMET ENCKE.

In March the comet will rise shortly before the sun, but not until the end of May will it be possible to observe it after the conjunction with the sun, and by that time it will be quite faint.

A few more observations of COMET 1927 *j* (SCHWASSMANN-WACHMANN) have been obtained, but it is now a very difficult object. From observations of November 15 (Bergedorf), December 14 and 29 (Yerkes), L. E. Cunningham has deduced the elements:

$$
\begin{aligned}
T &= 1925\ \text{July}\ 10.15 \\
\omega &= 343^\circ\ 29' \\
\Omega &= 323\ \ 50 \quad \} 1927.0 \\
i &= \ \ 9\ \ 30 \\
e &= 0.29 \\
a &= 6.685\ \text{astr. units} \\
q &= 4.751 \\
P &= 17.28\ \text{years}
\end{aligned}
$$

According to this orbit the comet comes inside of Jupiter's circuit during part of its revolution around the sun, but most of the time it is situated between the orbits of Jupiter and Saturn. The relative positions of the comet and the two planets are represented in Figure 2 for January 1 from year to year between 1924 and 1929. The smaller central circle represents the relative size of the orbit of the earth. The small inclinations of the orbits have been disregarded. Perturbations through the proximity of these two major planets must affect considerably the form of the curve described by the comet, especially when the comet crosses Jupiter's path as happened in 1924. On account of the unusually small value of the eccentricity, the distance of the comet from opposition to opposition changes

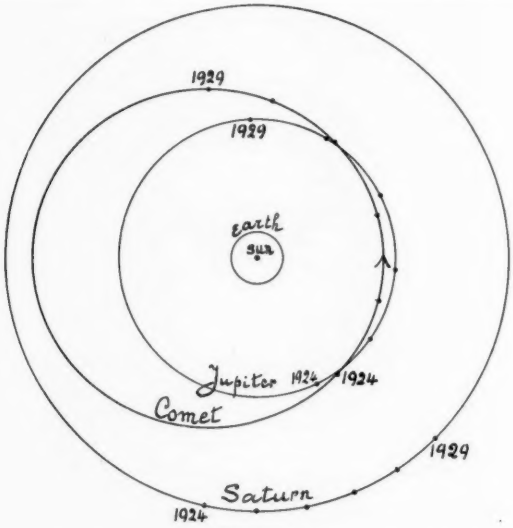


FIGURE 2
ORBIT OF COMET 1927 *j* (SCHWASSMANN-WACHMANN).

much less than is the case for any other comet. Between the most and the least favorable oppositions, the brightness changes only by two magnitudes. The present appearance being an intermediate one, there is a good chance that this comet will be observable, like an asteroid, from year to year all around its orbit, an unprecedented circumstance with any comet.

From a communication by H. E. Wood of Johannesburg COMET 1927 *c* (PERIODIC PONS-WINNECKE) was followed in South Africa until November 27. Since it moved northward after that date, there was a chance for northern observatories to record this comet once more. I succeeded in doing so on January 10, when two exposures with the 24-inch reflector show the comet as an extremely faint, small round nebulosity. No further observations are possible as the comet has moved too far into the western sky.

In the morning sky COMET 1927 *d* (STEARNS) and COMET 1927 *g* (PERIODIC SCHAUMASSE) have again been recorded several times during January. The former appears in the constellation of Hercules as a round coma nearly 1′ in diameter with central condensation; its brightness corresponds (Jan. 22) to $12\frac{1}{2}^{M}$. The latter is very much fainter (15^{M}) and its southern declination in Ophiuchus makes it only observable at a low altitude before sunrise.

Williams Bay, Wisconsin, January 23, 1928.

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1928							
					March							
	h m	° ′		d h	d h		d h		d h		d h	
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8					18	16		
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	4	14	11	18	18	22	26	2
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	8	2	15	13	23	1	30	13
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	1	21	7	23	20	5	26	8
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	4	8	10	1	21	11	27	5
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	1	6	8	3	21	23	28	17
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	5	12	10	7	19	21	24	15
ST Persei	53.7	+38 47	8 5—10.5	2 15.6	4	8	12	6	20	5	28	4
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6					25	22		
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	0	23	9	13	18	4	26	18
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	5	12	11	11	23	9	29	7
λ Tauri	55.1	+12 12	3 3— 4.2	3 22.9	4	3	12	1	19	23	27	20
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	0	5	8	11	16	19	25	3
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	6	6	12	5	24	0	29	22
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	5	9	18	13			31	18
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	4	2	10	9	22	23	29	6
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	7	14			20	0		
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	3	9	8	22	19	23	25	12
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	3	2	13	23	19	10	29	8
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	5	11	11	11	23	12	29	13
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	6	10	12	22	19	10	25	22
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	4	23	15	9	20	13	30	23
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	6	23	15	0	23	0	31	0
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	3	8	14	19	20	12	31	23
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	2	10	8	15	21	2	27	7
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	2	16	9	12	23	4	30	0
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	1	11	9	2	24	8	31	23
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	1	22	14	3			26	8
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	5	4	12	8	19	12	26	16
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	2	8	9	4	22	19	29	14
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	1	17	11	1	20	8	29	15
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	1	23	8	13	21	19	28	9
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	8	16	17	1			25	11
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	4	2	10	13	23	9	29	20
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	6	4	13	10	20	17	28	0
X Carinæ	8 29.1	—58 53	7.9— 8.7	0 13.0	4	12	11	12	18	13	25	14
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	4	2	13	14	23	2		
RX Hydræ	9 00.8	— 7 52	9.1—10.5	2 06.8	8	4			17	7	26	10
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	4	11	10	10	22	7	28	5
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	7	14	12	8	21	1	27	19
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	6	23	14	9	21	19	29	5
SS Carinæ	54.2	—61 23	12.2—12.8	3 07.2	1	14	8	5	21	10	28	1
RW Urs. Maj.	10 35.4	+52 34	10.3—11.4	7 07.9	6	3	13	11	20	19	28	3
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	1	21	8	16	22	6	29	1
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	7	19	15	7	22	19	30	7
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	1	3	10	17	20	7	29	22
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	8	8	15	18	23	5	30	15

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1928 March					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
SX Hydræ	13 39.0	−26 23	8.6—12.7	2 21.5	5 7	11 2	22 16	28 11		
δ Libræ	14 55.6	− 8 07	4.8— 6.2	2 07.9	4 13	11 12	18 12	25 12		
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	3 22	10 20	24 16	31 13		
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4		8 8	16 18	25 4		
SS Libræ	15 43.4	−15 14	9.3—11.5	0 18.4	6 0	13 5	20 9	27 14		
SW Ophiuchi	16 11.1	− 6 44	9.2—10.0	2 10.7	7 10	14 18	22 2	29 10		
SX Ophiuchi	12.6	− 6 25	10.5—11.2	2 01.5	3 20	10 0	22 10	28 14		
R Aræ	31.1	−56 48	6.8— 7.9	4 10.2	3 17	12 14	21 10	30 7		
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1		8 3		28 21		
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	3 5	10 0	23 14	30 10		
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	1 16.2	7 15	14 8	21 1	27 18		
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	3 3	9 7	21 14	27 18		
TX Herculis	15.4	+42 00	8.3— 9.0	2 01.4	1 23	8 3	20 12	26 16		
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	8 5	15 14	22 23	30 7		
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	3 20	13 16	23 11	28 9		
TX Scorpii	48.6	−34 13	7.5— 8.2	0 22.6	6 18	13 9	19 23	26 13		
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	5 22	16 18		27 14		
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	6 19	14 19	22 19	30 18		
WX Sagittarii	53.6	−17 24	9.2—10.8	2 03.1	5 4	11 13	24 8	30 17		
WY Sagittarii	17 54.9	−23 01	9.5—10.6	4 16.0	5 2	14 10	19 2	28 10		
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	4 22	15 6	20 11	30 19		
RS Sagittarii	11.0	−34 08	5.9— 6.3	2 10.0	6 1	13 7	20 13	27 19		
V Serpentis	11.1	−15 34	9.5—11.1	3 10.9	3 6	10 3	23 23	30 21		
RZ Scuti	21.1	− 9 15	7.4— 8.3	15 03.2	1 2		16 6	31 11		
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	1 19	9 12	17 6	24 23		
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	2 18	11 15	20 13	29 10		
SX Sagittarii	39.7	−30 36	8.7— 9.8	2 01.8	7 23	16 7		24 14		
RR Draconis	40.8	+62 34	9.3—13	2 19.9	2 4	10 15	19 3	27 15		
RS Scuti	43.7	−10 21	9.3—10.3	0 15.9	4 11	12 11	20 10	28 9		
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	4 15		17 13	30 11		
U Scuti	18 48.9	−12 44	9.1— 9.6	0 22.9	1 10	9 1	24 8	31 23		
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	8 4	15 18	23 8	30 16		
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	5 7	12 11	19 16	26 21		
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	7 4	16 3		25 1		
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	2 15	9 10	22 22	29 16		
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	8 5	15 14	22 23	28 8		
TT Lyræ	24.3	+41 30	9 4—11.6	5 05.8	1 17	12 4	17 10	27 22		
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	5 12	13 16	21 19	29 23		
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	5 3	11 3	23 3	29 4		
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6		9 20	19 19	29 17		
SW Cygni	03.8	+46 01	9. —11.7	4 13.8		8 5	17 8	27 12		
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	4 13	12 23	21 9	29 20		
RW Cancri.	12.2	−17 59	8.8—10.6	3 09.4	3 14	10 9	23 22	30 17		
UW Cygni	19.6	+42 55	10.5—13	3 10.8	2 11	9 9	23 4	30 2		
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0						
W Delphini	33.1	+17 56	9.4—12.1	4 19.4		9 22	19 13	29 3		
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	2 14	11 19	21 0	30 4		
Y Cygni	48.1	+34 17	7.1— 7.9	2 23.9	1 10	7 10	19 10	25 9		
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	4 14	11 18	18 21	26 0		
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	2 5	12 8	17 9	27 11		
RY Aquarii	21 14.8	−11 14	8.8—10.4	1 23.2	6 6	12 4	23 23	29 20		
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3			17 19			
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	2 10	12 14	17 16	27 19		
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	4 14	14 17	19 22	30 6		
VW Pegasi	22 51.7	+32 42	10.0—10.6	5 06.4	3 23	14 13	19 20	30 9		
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	5 10	12 22	20 11	28 0		
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	2 3	10 9	18 15	26 20		

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Maxima in 1928 March							
	h m	° ′		d h	d h		d h		d h		d h	
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7							27-21	
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	3	2	11	5	19	9	27	12
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	6	7	11	20	22	22	28	10
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2			15	10			30	5
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	2	7	9	5	23	3	30	2
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	1	1	8	20	16	15	24	11
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0			14	19			31	5
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	4	16	13	6	21	20	30	10
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	3	16	14	19			25	22
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0			9	2	20	17		
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	1	18	7	21	20	3	26	6
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3			9	5	19	9	29	12
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	6	21	14	15	22	8	30	1
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	2	13	13	14	19	3	30	5
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	4	14	12	4	19	18	27	7
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3					17	11		
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	3	4	10	15	18	2	25	13
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	7	16	15	14	23	12	31	10
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	5	14	15	18			25	22
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5	1	14			23	17		
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	1	2	9	1	16	23	24	22
V Carinæ	8 26.7	—59 47	7.4— 8.1	6 16.7	4	23	11	16	25	1	31	18
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	2	9	11	16	20	23	30	5
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	5	6	14	0	22	17	31	11
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7					17	5		
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	2	3	11	5	20	6	29	7
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	6	9	12	23	19	13	26	4
S Muscæ	12 07.4	—69 36	6.4— 7.3	9 15.8	8	9	18	1			27	17
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	4	8	10	1	21	10	27	3
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	2	21	9	15	23	2	29	19
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	2	18	14	9	20	5	31	21
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	1	16	11	1	20	10	29	19
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5			10	15			27	22
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	2	17	10	22	19	3	27	7
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	5	17	15	2			24	10
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	6	1	14	7	22	12	30	17
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	4	16	10	4	21	4	26	15
RS Bootis	14 29.3	+32 11	8.9—10.0	0 09.1	8	4	15	17	23	6	30	19
R Trian. Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	2	10	12	14	19	9	29	13
S Trian. Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	5	14	11	22	24	14	30	21
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	2	2	12	20	22	14		
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	1	3	7	18	21	1	27	17
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	2	1	8	2	20	5	26	7
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	7	23	14	23	21	23	28	23
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9			12	23			30	2
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	1	5	8	19	16	9	23	23
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	1	11	13	1	18	19	30	8
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	3	3	9	20	23	8	30	2
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	3	7	13	16	23	23		
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	1	13	9	5	16	21	24	13
RT Scuti	44.1	—10 30	9.1— 9.7	0 11.9	7	6	14	17	22	3	**29**	**14**
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	5	22	14	23			24	2

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Maxima in 1928 March							
	h m	° ′		d h	d h	d h	d h	d h				
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	1 6	8 7	22 8	29 9				
XZ Cygni	30.4	+56 10	8.6— 9.3	0 11.2	3 5	10 5	17 5	24 4				
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	8 19		16 19	24 19				
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	3 2	10 18	18 11	26 4				
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	6 19	13 23	21 3	28 7				
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	5 8	13 18	22 3	30 12				
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	0 11	6 18	19 9	25 17				
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	8 2		24 11					
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	1 8	10 5	19 2	27 23				
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	1 22	13 3	18 18	29 23				
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	2 21	11 20	20 19	29 18				
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4		15 6		29 23				
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	5 21	13 18	21 14	29 11				
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	4 13	13 17	18 8	27 12				
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	5 12	15 5	20 2	29 19				
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	5 4	13 19	18 3	26 19				
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	5 6	10 14	21 8	26 17				
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	9 11		20 8	31 5				
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	2 5	8 15	21 10	27 20				
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	2 10	12 9	17 9	27 8				
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	3 5	14 3	19 13	30 11				
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	5 11	10 22	21 19	27 5				
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	2 20	9 3	21 17	28 0				
RY Cassiop.	23 47.2	+58 11	9.3—11.8	12 03.4		10 0	22 4					

Monthly Report of the American Association of Variable Star Observers, for the Month of December, 1927.

We welcome lists from two new observers, Mr. F. W. Smith of Haverford College, Haverford, Pa., and Mr. C. R. Gregory of Auburn, N. Y. Also we are pleased to have another splendid communication of observations from Buenos Aires, sent in by Sr. Dartayet who has recently joined the Association as an active member. He is our lone variable star observer in South America and is anxious to create a center of activity in his own city. Applications have been received from Dr. Clyde Fisher of the Natural History Museum, New York, and Mr. Max Beyer of Hamburg, Germany. This is the first such application from that country and we hope it means greater interest there in variable star astronomy, especially among the German amateurs.

Professor Olivier again appeals to AAVSO members to aid in the work of telescope meteor observing. He reports that to the end of 1925 he had received 796 observations of telescopic meteors; a great part of this work being due to the coöperation of the AAVSO. He needs still more help in this very important problem, and considering the ease with which such observations can be made—without interfering with the regular variable star program—he should be given all possible aid. The following data are indispensable: Date, hour and minute of appearance of the telescopic meteor, and the magnitude to the nearest whole magnitude only. In addition it will greatly facilitate matters, if the observers also cite the position of the telescope when the meteor passed through the field—

Variable Star Observations Received During December, 1927.

Oct. 0 = J.D. 2425154; Nov. 0 = J.D. 2425185; Dec. 0 = J.D. 2425215.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V Scl	R And	X Scl	Y And	o Cet	R Tri
000339	001838	*004435*	013338	*021403*	023133
170 14.5 Bl	196 9.5 Ch	170 11.4 Bl	196 8.4 Ch	200 5.2 Ch	150 8.7 Ch
S Scl	205 9.6 Jo	177 11.2 Bl	210 8.5 Pt	201 5.6 Kd	168 7.9 Sf
001032	210 9.5 Pt	— Cas	224 9.5 Al	202 5.6 Kd	174 7.7 Sf
157 7.9 Ht	217 10.1 Sb	004746b	232 9.5 Kz	204 5.5 Kd	181 7.5 Sf
158 8.0 Bl	224 9.5 Fd	210 10.2 Pt	232 9.6 Eb	205 5.4 Gs	196 7.3 Sf
165 7.7 Bl	226 10.8 Sb	232 10.9 Kz	X Cas	206 5.6 Wk	196 5.8 Ch
168 7.9 Sm	227 10.5 Lb	232 11.2 Eb	014958	206 5.4 Ch	205 6.3 Jo
169 7.7 Ht	227 10.5 Pn	W Cas	197 12.3 Bn	207 5.4 Ch	206 6.2 B
173 7.6 Ht	229 10.5 Pn	004958	201 12.3 Bn	207 5.4 L	210 6.0 Pt
177 7.9 En	229 10.5 Lb	205 8.5 Jo	209 12.2 Bn	208 5.5 Sp	214 5.8 Gs
177 7.7 Bl	231 11.2 Sb	206 8.9 B	210 11.8 Pt	210 5.2 Pt	214 7.0 Sf
180 7.7 Sm	232 11.2 Kz	210 9.0 Pt	216 10.7 B	214 5.7 Gs	227 6.5 Jo
183 7.5 Ht	232 11.1 Eb	227 8.7 Jo	U Per	229 6.5 Gy	229 6.4 Kz
183 7.5 En	S Tuc	232 8.5 Hu	015254	229 6.0 Sp	229 6.8 Eb
185 7.4 Dr	*001862*	U Tuc	210 10.0 Pt	234 6.0 Rw	232 5.5 Hu
192 7.6 Dr	155[11.3 En	*005475*	211 10.3 B	S Per	W Per
198 7.5 Dr	170[14.0 Bl	155 9.5 En	R Ari	021558	024356
201 7.4 Dr	175[13.2 Sm	158 9.8 Bl	021024	171 10.4 Kl	205 9.7 Jo
201 7.7 Kd	182[13.2 Sm	165 9.9 Bl	156 12.3 Ch	197 9.7 Ch	210 9.7 Pt
202 7.8 Kd	S Cet	168 9.8 Sm	199 9.8 Ch	200 9.6 GC	211 9.4 B
202 7.4 Dr	*001900*	175 10.3 Sm	203 8.0 Fd	203 9.6 GC	229 10.2 Kz
204 7.8 Kd	200[13 3 L	176 10.8 En	206 10.3 B	210 9.8 Kl	229 9.9 Eb
207 7.7 Dr	205[13.7 Lg	177 11.0 Bl	210 9 1 Pt	210 9.0 Pt	232 9 2 Hu
209 7.7 Dr	211[13.8 Lg	182 10.8 Sm	217 8.9 Fd	214 9.4 GC	R Hor
210 7.9 Pt	T Phe	183 11.0 En	W And	215 10.0 Kl	*025050*
213 7.8 Dr	*002546*	Z Cet	021143a	232 9.2 Hu	155 12.2 En
X And	155[12.2 En	*010102*	207 13.4 Ch	R Cet	158 10.8 Bl
001046	170[14.1 Bl	206 8.9 B	210 11.5 Pt	*022000*	165 11.0 Bl
204 12.6 GC	174[13.2 Sm	210 8.3 Pt	229[11.9 Eb	197 8.1 Ch	168 11.5 Sm
210 12.6 GC	180[13.2 Sm	U Scl	T Per	205 9.5 Jo	169 11.3 Ht
211 12.0 B	T Psc	*010630*	021258	229 10.2 Kz	174 11.5 Sm
232[13.0 Eb	002614	170 13.5 Bl	197 9.0 Ch	229 9.9 Sp	175 11.3 Ht
T Cet	200 12.2 GC	U And	210 8.4 Pt	229 10.1 Eb	176 10.6 En
001620	203 12.0 GC	010940	Z Cep	RR Per	177 10.6 Bl
188 5.9 L	210 12.4 GC	218 12.7 Lg	021281	022150	180 11.3 Sm
196 6.3 Kd	W Scl	232[12 6 Kz	206 13.7 B	210 13.1 Pt	183 11.1 Ht
197 6.4 Kd	*002833*	U Psc	210 13.6 Pt	R For	183 10.6 En
200 6.1 L	170 13.0 Bl	011712	o Cet	*022426*	T Hor
201 6 3 Kd	Y Cep	210 11.4 Pt	*021403*	158 10.7 Bl	*025751*
T And	003179	227 11.4 Al	145 4.4 Ch	165 9.8 Bl	168 11.3 Sm
001726	214 12.0 B	RZ Per	157 4.5 Ch	177 9.8 Bl	170 11 0 Bl
196 11.0 Ch	U Cas	012350	168 4.1 Sm	U Cet	174 11.1 Sm
206 10.4 Wk	004047	206 10 4 B	175 4.3 Sm	*022813*	177 11.2 Bl
210 9.8 Pt	210 11.1 Pt	227 10.6 Al	176 4.6 En	210 10.4 Pt	180 10.9 Sm
220 9.7 Cl	220 10.6 Cl	R Psc	176 4.9 Ch	RR Cep	X Cet
229 8 7 Kz	229 9.5 Kz	012502	177 4 3 Sm	022980	*031401*
229 9.1 Eb	229 9 6 Eb	197 11.4 Ch	179 4.8 En	188 10.8 L	204 9.8 B
T Cas	V And	210 10.8 Pt	180 5.0 Ch	200 10.8 L	210 9.7 Pt
001755	004435	229 8.6 Kz	183 4.3 Sm	205 10.4 Lg	227 9.3 Cl
188 12.1 L	204 9.9 GC	229 8.7 Eb	183 4.8 En	210 11.1 Pt	229 8.7 Kz
200 12.1 L	229 9.6 Kz	RU And	186 4.2 L	212 11.3 L	229 8.9 Eb
210 12.0 Pt	229 9 9 Eb	013238	188 4.2 Be	217 10.5 Lg	Y Per
212 12.0 L	232 9 3 Hu	196 10.9 Ch	196 5.6 Kd	223 9.9 Lg	032043
232 11.7 Eb	232 9 6 Eb	210 10.5 Pt	197 5.6 Kd	232 12.4 Kz	210 8.6 Pt
232 11.6 Kz	232 9.9 Eb	224 10.2 Al	197 5.1 Ch	232 12.3 Eb	211 9.7 B
		232 10.0 Al	197 4.3 L		229 9.3 Kz
		232 10.0 Eb	199 5.6 Kd		229 9.6 Eb

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Maxima in 1928 March							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	1 6	8 7	22 8	29 9				
XZ Cygni	30.4	+56 10	8.6— 9.3	0 11.2	3 5	10 5	17 5	24 4				
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	8 19		16 19	24 19				
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	3 2	10 18	18 11	26 4				
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	6 19	13 23	21 3	28 7				
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	5 8	13 18	22 3	30 12				
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	0 11	6 18	19 9	25 17				
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	8 2		24 11					
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	1 8	10 5	19 2	27 23				
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	1 22	13 3	18 18	29 23				
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	2 21	11 20	20 19	29 18				
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4		15 6		29 23				
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	5 21	13 18	21 14	29 11				
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	4 13	13 17	18 8	27 12				
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	5 12	15 5	20 2	29 19				
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	5 4	13 19	18 3	26 19				
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	5 6	10 14	21 8	26 17				
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	9 11		20 8	31 5				
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	2 5	8 15	21 10	27 20				
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	2 10	12 9	17 9	27 8				
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	3 5	14 3	19 13	30 11				
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	5 11	10 22	21 19	27 5				
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	2 20	9 3	21 17	28 0				
RY Cassiop.	23 47.2	+58 11	9.3—11.8	12 03.4		10 0	22 4					

Monthly Report of the American Association of Variable Star Observers, for the Month of December, 1927.

We welcome lists from two new observers, Mr. F. W. Smith of Haverford College, Haverford, Pa., and Mr. C. R. Gregory of Auburn, N. Y. Also we are pleased to have another splendid communication of observations from Buenos Aires, sent in by Sr. Dartayet who has recently joined the Association as an active member. He is our lone variable star observer in South America and is anxious to create a center of activity in his own city. Applications have been received from Dr. Clyde Fisher of the Natural History Museum, New York, and Mr. Max Beyer of Hamburg, Germany. This is the first such application from that country and we hope it means greater interest there in variable star astronomy, especially among the German amateurs.

Professor Olivier again appeals to AAVSO members to aid in the work of telescope meteor observing. He reports that to the end of 1925 he had received 796 observations of telescopic meteors; a great part of this work being due to the coöperation of the AAVSO. He needs still more help in this very important problem, and considering the ease with which such observations can be made—without interfering with the regular variable star program—he should be given all possible aid. The following data are indispensable: Date, hour and minute of appearance of the telescopic meteor, and the magnitude to the nearest whole magnitude only. In addition it will greatly facilitate matters, if the observers also cite the position of the telescope when the meteor passed through the field—

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1927.

Oct. 0 = J.D. 2425154; Nov. 0 = J.D. 2425185; Dec. 0 = J.D. 2425215.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V Scl	R And	X Scl	Y And	o Cet	R Tri
000339	001838	*004435*	013338	*021403*	023133
170 14.5 Bl	196 9.5 Ch	170 11.4 Bl	196 8.4 Ch	200 5.2 Ch	150 8.7 Ch
S Scl	205 9.6 Jo	177 11.2 Bl	210 8.5 Pt	201 5.6 Kd	168 7.9 Sf
001032	210 9.5 Pt	— Cas	224 9.5 Al	202 5.6 Kd	174 7.7 Sf
157 7.9 Ht	217 10.1 Sb	004746b	232 9.5 Kz	204 5.5 Kd	181 7.5 Sf
158 8.0 Bl	224 9.5 Fd	210 10.2 Pt	232 9.6 Eb	205 5.4 Gs	196 7.3 Sf
165 7.7 Bl	226 10.8 Sb	232 10.9 Kz	X Cas	206 5.6 Wk	196 5.8 Ch
168 7.9 Sm	227 10.5 Lb	232 11.2 Eb	014958	206 5.4 Ch	205 6.3 Jo
169 7.7 Ht	227 10.5 Pn	W Cas	197 12.3 Bn	207 5.4 Ch	206 6.2 B
173 7.6 Ht	229 10.5 Pn	004958	201 12.3 Bn	207 5.4 L	210 6.0 Pt
177 7.9 En	229 10.5 Lb	205 8.5 Jo	209 12.2 Bn	208 5.5 Sp	214 5.8 Gs
177 7.7 Bl	231 11.2 Sb	206 8.9 B	210 11.8 Pt	210 5.2 Pt	214 7.0 Sf
180 7.7 Sm	232 11.2 Kz	210 9.0 Pt	216 10.7 B	214 5.7 Gs	227 6.5 Jo
183 7.5 Ht	232 11.1 Eb	227 8.7 Jo	U Per	229 6.5 Gy	229 6.4 Kz
183 7.5 En	S Tuc	232 8.5 Hu	015254	229 6.0 Sp	229 6.8 Eb
185 7.4 Dr	*001862*	U Tuc	210 10.0 Pt	234 6.0 Rw	232 5.5 Hu
192 7.6 Dr	155[11.3 En	*005475*	211 10.3 B	S Per	W Per
198 7.5 Dr	170[14.0 Bl	155 9.5 En	R Ari	021558	024356
201 7.4 Dr	175[13.2 Sm	158 9.8 Bl	021024	171 10.4 Kl	205 9.7 Jo
201 7.7 Kd	182[13.2 Sm	165 9.9 Bl	156 12.3 Ch	197 9.7 Ch	210 9.7 Pt
202 7.8 Kd	S Cet	168 9.8 Sm	199 9.8 Ch	200 9.6 GC	211 9.4 B
202 7.4 Dr	*001909*	175 10.3 Sm	203 8.0 Fd	203 9.6 GC	229 10.2 Kz
204 7.8 Kd	200[13 3 L	176 10.8 En	206 10.3 B	210 9.8 Kl	229 9.9 Eb
207 7.7 Dr	205[13.7 Lg	177 11.0 Bl	210 9 1 Pt	210 9.0 Pt	232 9 2 Hu
209 7.7 Dr	211[13.8 Lg	182 10.8 Sm	217 8.9 Fd	214 9.4 GC	R Hor
210 7.9 Pt	T Phe	183 11.0 En	W And	215 10.0 Kl	*025050*
213 7.8 Dr	*002546*	Z Cet	021143a	232 9.2 Hu	155 12.2 En
X And	155[12.2 En	*010102*	207 13.4 Ch	R Cet	158 10.8 Bl
001046	170[14.1 Bl	206 8.9 B	210 11.5 Pt	*022000*	165 11.0 Bl
204 12.6 GC	174[13.2 Sm	210 8.3 Pt	229[11.9 Eb	197 8.1 Ch	168 11.5 Sm
210 12.6 GC	180[13.2 Sm	U Scl	T Per	205 9.5 Jo	169 11.3 Ht
211 12.0 B	T Psc	*010630*	021258	229 10.2 Kz	174 11.5 Sm
232[13.0 Eb	002614	170 13.5 Bl	197 9.0 Ch	229 9.9 Sp	175 11.3 Ht
T Cet	200 12.2 GC	U And	210 8.4 Pt	229 10.1 Eb	176 10.6 En
001620	203 12.0 GC	010940	Z Cep	RR Per	177 10.6 Bl
188 5.9 L	210 12.4 GC	218 12.7 Lg	021281	022150	180 11.3 Sm
196 6.3 Kd	W Scl	232[12 6 Kz	206 13.7 B	210 13.1 Pt	183 11.1 Ht
197 6.4 Kd	*002833*	U Psc	210 13.6 Pt	R For	183 10.6 En
200 6.1 L	170 13.0 Bl	011712	o Cet	*022426*	T Hor
201 6 3 Kd	Y Cep	210 11.4 Pt	*021403*	158 10.7 Bl	*025751*
T And	003179	227 11.4 Al	145 4.4 Ch	165 9.8 Bl	168 11.3 Sm
001726	214 12.0 B	RZ Per	157 4.5 Ch	177 9.8 Bl	170 11 0 Bl
196 11.0 Ch	U Cas	012350	168 4.1 Sm	U Cet	174 11.1 Sm
206 10.4 Wk	004047	206 10 4 B	175 4.3 Sm	*022813*	177 11.2 Bl
210 9.8 Pt	210 11.1 Pt	227 10.6 Al	176 4.6 En	210 10.4 Pt	180 10.9 Sm
220 9.7 Cl	220 10.6 Cl	R Psc	176 4.9 Ch	RR Cep	X Cet
229 8 7 Kz	229 9.5 Kz	012502	177 4 3 Sm	022980	*031401*
229 9.1 Eb	229 9 6 Eb	197 11.4 Ch	179 4.8 En	188 10.8 L	204 9.8 B
T Cas	V And	210 10.8 Pt	180 5.0 Ch	200 10.8 L	210 9.7 Pt
001755	004435	229 8.6 Kz	183 4.3 Sm	205 10.4 Lg	227 9.3 Cl
188 12.1 L	204 9.9 GC	229 8.7 Eb	183 4.8 En	210 11.1 Pt	229 8.7 Kz
200 12.1 L	229 9.6 Kz	RU And	186 4.2 L	212 11.3 L	229 8.9 Eb
210 12.0 Pt	229 9 9 Eb	013238	188 4.2 Be	217 10.5 Lg	Y Per
212 12.0 L	232 9 3 Hu	196 10.9 Ch	196 5.6 Kd	223 9.9 Lg	032043
232 11.7 Eb	232 9 6 Eb	210 10.5 Pt	197 5.6 Kd	232 12.4 Kz	210 8.6 Pt
232 11.6 Kz	232 9.9 Eb	224 10.2 Al	197 5.1 Ch	232 12.3 Eb	211 9.7 B
		232 10.0 Al	197 4.3 L		229 9.3 Kz
		232 10.0 Eb	199 5.6 Kd		229 9.6 Eb

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
Y PER	T CAM	R PIC	R AUR	T ORI	R COL
032043	043065	*044349*	050953	*053005a*	*054629*
232 8.5 Hu	217 11.3 Lg	178 7.8 En	210 10.6 Cb	217 10.4 Pt	170[12.4 Sm
R PER	RX TAU	180 8.8 Dr	210 9.4 Pt	217 11.0 B	177[13.0 Bl
032335	043208	185 8.9 Dr	T PIC	219 10.4 Pt	182[12.4 Sm
205 9.3 Lg	210 9.7 Pt	185 8.5 En	*051247*	220 10.3 Pt	183[12.4 Ht
210 9.0 Pt	214 10.2 B	192 8.9 Dr	155[13.1 Ht	229 9.9 Kz	U ORI
211 8.9 B	229 10.7 Kz	198 9.1 Dr	169 12.2 Ht	229 9.8 Eb	054920a
213 9.5 Lg	229 10.8 Eb	201 9.1 Dr	170 11.8 Sm	229 10.0 Sp	157 6.6 Ch
214 8.9 Gs	R RET	204 9.2 Dr	170 12.2 Bl	233 10.5 Ie	198 7.8 Ch
217 9.0 Lg	*043263*	207 9.2 Dr	175 11.7 Ht	S CAM	203 9.0 Fd
221 9.2 Lg	155[12.2 En	209 9.2 Dr	175 11.4 Sm	053068	205 7.7 Jo
229 10.3 Kz	158[12.5 Bl	213 9.2 Dr	177 11.1 Bl	207 10.7 Wk	208 7.8 B
229 10.3 Eb	169 12.4 Ht	V TAU	178 11.2 En	210 10.6 Pt	210 8.0 Ch
U CAM	170 12.3 Bl	044617	182 11.0 Sm	RR TAU	210 7.6 Pt
033362	174 12.1 Sm	204[13.5 GC	183 10.6 En	053326	216 7.9 B
214 8.0 By	175 12.4 Ht	210 13.6 GC	183 11.2 Ht	203 13.0 B	217 8.7 Fd
T ERI	176 12.2 En	211 13.2 B	T COL	214 12.6 B	227 8.7 Lb
035124	177 12.1 Bl	232 12.2 Kz	*051533*	RU AUR	227 8.8 Pn
180 8.0 Dr	180 12.0 Sm	232 12.2 Eb	155 11.2 Ht	053337	229 8.7 Lb
185 8.0 Dr	183 11.7 En	R ORI	158 10.7 Bl	210 10.6 Pt	229 8.7 Pn
192 8.0 Dr	183 11.7 Ht	045307	169 10.2 Ht	U AUR	234 8.7 Rw
198 8.8 Dr	X CAM	215 9.8 B	170 10.2 Sm	053531	UW ORI
201 8.4 Dr	043274	R LEP	175 10.1 Sm	199 11.0 Ch	054920b
202 8.6 Dr	210 10.8 Pt	*045514*	175 9.8 Ht	210 8.9 Pt	210 10.8 Cb
204 8.6 Dr	214 10.9 B	198 8.9 Ch	177 9.7 Bl	214 9.2 B	Z AUR
207 8.8 Dr	R DOR	203 6.2 Fd	178 9.8 En	SU TAU	055353
209 8.8 Dr	*043562*	205 8.2 Jo	180 10.2 Dr	054319	199 10.7 Ch
213 9.0 Dr	155 5.4 En	210 7.6 Pt	182 9.7 Sm	152 9.8 Ch	204 10.2 B
T TAU	155 5.4 Ht	217 8.4 B	183 9.7 Ht	198 9.9 Ch	205 10.0 Pt
041619	158 5.6 Bl	217 6.4 Fd	183 9.5 En	203 9.9 Ch	207 10.0 Pt
200 10.4 GC	165 5.0 Bl	227 8.4 Jo	185 10.0 Dr	204 9.7 B	214 10.0 Pt
203 10.7 GC	168 5.8 Sm	V ORI	192 9.5 Dr	207 9.6 Pt	215 10.0 Pt
210 10.4 GC	169 5.5 Ht	050003	198 9.0 Dr	210 9.6 Pt	217 9.9 Pt
R TAU	174 5.5 Sm	198 10.0 Ch	201 9.2 Dr	212 9.7 L	219 10.0 Pt
042209	175 5.5 Ht	204 9.8 B	202 9.2 Dr	215 9.6 Pt	220 9.7 Pt
198 9.0 Ch	176 5.6 En	210 9.3 Pt	204 8.7 Dr	216 9.7 B	221 9.8 Pt
210 8.3 Pt	177 5.0 Bl	211 10.0 Lg	207 8.7 Dr	217 9.7 Pt	R OCT
211 8.3 B	180 5.5 Sm	213 10.1 Lg	209 8.5 Dr	219 9.6 Pt	*055686*
232 8.3 Kz	183 5.6 En	217 10.0 Lg	213 8.5 Dr	220 9.7 Pt	170 12.4 Bl
232 8.5 Eb	183 5.5 Ht	217 9.4 B	S AUR	232 9.6 Kz	177[12.0 Sm
W TAU	R CAE	229 9.8 Kz	052034	232 9.8 Eb	X AUR
042215	*043738*	229 9.7 Eb	199 9.0 Ch	233 9.9 Ie	060450
205 9.9 Jo	155 11.0 Ht	T LEP	206 8.8 B	S COL	200 10.0 Ch
206 10.1 B	158 11.0 Bl	*050022*	210 8.1 Pt	*054331*	204 9.2 Ch
210 10.5 B	165 11.0 Bl	158 11.1 Bl	216 8.9 B	155[12.6 Ht	207 9.0 Ch
210 10.4 Pt	169 11.2 Ht	177 10.4 Bl	227 8.8 Jo	158 12.8 Bl	208 9.2 B
227 10.7 Jo	170 11.3 Sm	210 9.5 Pt	W AUR	169[12.6 Ht	210 9.0 Pt
229 10.9 Kz	175 11.4 Ht	S PIC	052036	170 12.2 Sm	216 9.2 B
229 10.7 Eb	175 11.2 Sm	*050848*	211 13.1 B	175 12.0 Sm	V AUR
S TAU	177 11.3 Bl	158 10.9 Bl	S ORI	175 12.4 Ht	061647
042309	178 11.5 En	165 10.6 Bl	*052401*	177 12.4 Bl	208 11.1 B
211[13.5 B	182 11.2 Sm	170 11.7 Sm	210 10.5 Pt	178 11.7 En	217 11.4 B
T CAM	183 11.4 Ht	175 11.8 Sm	T ORI	182 12.0 Sm	V MON
043065	183 11.3 En	177 11.5 Bl	*053005a*	183 12.2 En	*061702*
189 10.8 L	R PIC	177 11.5 En	200 10.1 L	183 12.4 Ht	200 7.2 Ch
200 10.8 L	*044349*	182 11.8 Sm	204 11.0 B	R COL	210 7.0 Pt
203 11.1 Lg	158 7.4 Bl	183 11.2 En	210 10.4 Pt	*054629*	— AUR
206 11.2 Lg	165 7.2 Bl		212 10.3 L	155[12.4 Ht	062047
210 11.6 Pt	177 7.6 Bl		215 10.3 Pt	169[12.4 Ht	197 9.5 L

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
— AUR	RR MON	T HYA	V LEO	SU VIR	R HYA
062047	071201	*085008*	095421	120012	*132422*
208 9.4 L	205[12.5 Ch	162 9.4 Ch	217 9.0 Pt	217 10.7 Pt	022 7.2 Kd
R MON	V GEM	205 8.3 Ch	RV CAR	SS VIR	023 7.0 Kd
063308	**071713**	212 7.9 L	*095563*	122001	026 7.1 Kd
210 10.8 Pt	217 13.5 Pt	217 7.4 Pt	177[13.5 Bl	212 7.2 L	027 7.1 Kd
NOV PIC	S CMI	T CNC	S CAR	T CVN	030 7.0 Kd
063462	072708	085120	*100661*	122532	052 6.5 Kd
155 6.6 Ht	203 8.4 Fd	205 9.0 Ch	158 6.8 Bl	217 11.0 Pt	054 6.2 Kd
169 6.6 Ht	217 8.0 Fd	210 8.0 Pt	164 6.6 Bl	U CEN	061 6.1 Kd
170 6.5 Sm	217 7.3 Pt	T PYX	175 6.9 Ht	*122854*	078 5.3 Kd
174 6.3 Sm	224 8.2 Fd	*090031*	177 6.7 Bl	164 9.2 Bl	084 5.1 Kd
175 6.5 Ht	S VOL	177 [u Bl	178 6.9 Dr	177 8.5 Bl	217 6.2 Pt
177 6.3 Sm	*073173*	V UMA	192 6.8 Dr	T UMA	RV CEN
182 6.3 Sm	170[13.2 Bl	090151	198 6.2 Dr	123160	*133155*
183 6.5 Ht	U CMI	202 10.1 L	201 5.9 Dr	157 8.9 Kl	158 8.9 Bl
S LYN	073508	RW CAR	202 6.0 Dr	172 9.6 Kl	164 8.9 Bl
063558	212 11.9 L	*091868*	204 5.9 Dr	174 9.7 Kl	175 8.8 Bl
210 14.2 Pt	217 12.1 Pt	158 11.2 Bl	207 5.8 Dr	178 9.7 Kl	T CEN
216 13.7 B	S GEM	165 10.5 Bl	209 5.8 Dr	199 11.0 Kl	*13363?*
X GEM	073723	177 10.3 Bl	213 5.8 Dr	217 12.5 Pt	022 7.0 Kd
064030	217 12.9 Pt	Y VEL	Z CAR	217[11.0 Gb	023 7.0 Kd
201 13.2 Bn	W PUP	*002551*	*101058*	R VIR	030 6.5 Kd
209 12.7 Bn	*074241*	177 13.7 Bl	177 11.5 Bl	123307	052 5.9 Kd
Y MON	158 11.0 Bl	R CAR	W VEL	217 9.0 Pt	054 5.9 Kd
065111	169 9.4 Ht	*002962*	*101153*	RS UMA	061 6.2 Kd
205 10.0 Ch	175 9.2 Ht	158 8.8 Bl	177 12.2 Bl	123459	164 6.9 Bl
210 9.7 Pt	177 9.0 Bl	175 9.2 Ht	U HYA	217 12.9 Pt	RT CEN
X MON	183 8.7 Ht	177 8.9 Bl	*103212*	S UMA	*134236*
065208	183 8.5 Sm	178 9.3 Dr	022 5.8 Kd	123961	164 9.3 Bl
205 7.3 Ch	T GEM	192 9.4 Dr	026 5.7 Kd	157 8.3 Kl	R CVN
212 7.5 L	074323	198 9.6 Dr	030 5.7 Kd	162 8.3 Kl	134440
V CMI	217 10.8 Pt	201 9.7 Dr	054 5.7 Kd	171 8.2 Kl	217 10.4 Pt
070109	R CNC	202 9.6 Dr	R UMA	174 8.2 Kl	T APS
205 9.6 Ch	081112	204 9.6 Dr	103769	178 8.2 Kl	*134677*
R GEM	162 11.5 Ch	207 9.6 Dr	217 12.7 Pt	199 8.4 Kl	158 8.9 Bl
070122a	205 11.0 Ch	209 9.4 Dr	V HYA	205 8.5 Jo	164 9.0 Bl
157 9.6 Ch	217 10.7 Pt	213 9.6 Dr	*104620*	206 8.1 Wk	170 8.8 Sm
200 6.4 Ch	Z CAM	X HYA	177 8.4 Bl	210 8.5 Kl	175 9.0 Sm
210 6.5 Pt	081473	*093014*	217 7.9 Pt	215 8.8 Kl	175 9.0 Bl
221 6.5 Al	207 10.5 L	217 10.9 Pt	RS HYA	217 8.6 Pt	182 9.5 Bl
Z GEM	V CNC	R LMI	*104628*	217 9.0 Gb	182 9.0 Sm
070122b	081617	093934	177[13.7 Bl	227 8.4 Jo	R CEN
210 12.4 Pt	205 9.0 Ch	162 11.8 Ch	S LEO	RU VIR	*140950*
TW GEM	217 8.2 Pt	217 12.5 Pt	110506	124204	155 5.8 En
070122c	RT HYA	R LEO	217 11.6 Pt	217 11.5 Pt	158 5.7 Ht
210 8.2 Pt	*082405*	094211	RY CAR	U OCT	158 5.4 Bl
R CMI	217 7.8 Pt	162 6.5 Ch	*111561*	*131283*	164 5.7 Bl
070310	R CHA	203 6.8 Fd	169[12.7 Bl	158 10.4 Bl	165 5.4 En
212 9.0 L	*082476*	205 5.8 Ch	177[13.5 Bl	164 10.3 Bl	166 6.1 Dr
R VOL	170[12.6 Bl	217 5.9 Pt	RS CEN	168 10.5 Sm	168 5.8 Sm
070772	178[12.4 En	224 6.6 Fd	*111661*	169 10.1 Ht	169 5.9 Ht
155 10.9 Ht	182[12.4 Sm	Y HYA	169 10.6 Bl	174 10.3 Sm	171 5.9 Dr
169 12.1 Ht	183 12.4 En	*094622*	177 9.8 Bl	175 10.1 Ht	172 6.1 Dr
170 11.8 Sm	S HYA	217 6.4 Pt	X CEN	175 9.9 Bl	173 5.9 Ht
175 12.2 Sm	084803	Z VEL	*114441*	177 9.6 En	174 5.5 Sm
175 12.4 Ht	162 10.8 Ch	*094953*	177[13.1 Bl	180 9.7 Sm	175 5.4 Bl
182 12.6 Sm	205 9.8 Ch	177 14.0 Bl	W CEN	182 9.3 Bl	176 5.5 En
183 12.6 Ht	217 9.3 Pt		*115058*		178 5.5 En
			169 12.9 Bl		180 6.2 Dr

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R CEN	R NOR	R CRB	R SCO	RR SCO	SV SCO
140959	*152849*	154428	*161122a*	*165030*	*174135*
185 6.3 Dr	174 10.2 Sm	200 6.1 L	168[12.6 Bl	054 6.6 Kd	169 12 6 Bl
192 6.3 Dr	175 10.0 Bl	201 6.1 L	174[12.2 Sm	061 6.8 Kd	176 12.1 Bl
201 6.5 Dr	177 10.0 En	204 6.0 Kd	S SCO	065 6.6 Kd	W PAV
U UMI	180 10.2 Sm	205 6.0 Ie	*161122b*	070 6.9 Kd	*174162*
141567	185 10.2 Dr	210 6.2 Pt	168[12.6 Bl	078 7.3 Kd	158 11.6 Bl
206 9.4 Wk	X LIB	212 6.1 L	174[12.0 Sm	157 11.0 Ht	164 11.6 Bl
217 9.0 Pt	*153020*	214 6.2 Pt	W CRB	158 10.4 Bl	168 11.1 Sm
217 9.1 Sb	169 11.2 Bl	217 6.1 Pt	161138	164 10.7 Bl	169 12.3 Ht
226 9.7 Sb	W LIB	219 6.1 Pt	164 10.7 Bl	169 11.4 Ht	173 12.1 Ht
231 10.1 Sb	*153215*	220 6.2 Pt	210 11.8 Pt	169 11.4 Ht	175 12.1 Sm
S BOO	169[12.5 Bl	X CRB	U HER	171 12.1 Dr	176 12.2 Bl
141954	S UMI	154536	162119	172 11.7 Dr	176 12.1 En
190 8.3 L	153378	217 13.1 Pt	172 9.0 Kl	173 11.3 Ht	180 12.3 Sm
201 8.4 L	199 8.6 Ch	R SER	178 9.2 Kl	174 11.7 Sm	183 12.7 En
212 8.7 L	205 8.5 Jo	154615	210 9.5 Pt	176 11.2 Bl	U ARA
217 8.9 Pt	217 8.4 Pt	145 12.1 Ch	SS HER	176 11.4 En	*174551*
V BOO	227 8.4 Jo	217 8.6 Pt	162807	180 12.2 Sm	168 10.8 Sm
142539a	U LIB	V CRB	186 11.8 L	183 11.5 En	174 10.7 Sm
217 7.3 Pt	*153620a*	154639	202 11 5 L	RV HER	176 10.6 En
R BOO	169[12 9 Bl	217 8.5 Pt	T OPH	165631	180 10.5 Sm
143227	T NOR	RR LIB	*162815*	210 11.2 Pt	183 10.6 En
217 11.5 Pt	*153654*	*155018*	168[12.0 Bl	RT SCO	RT OPH
Y LUP	158 9.4 Ht	145 11.8 Ch	S OPH	*165636*	175111
145254	168 8.3 Sm	151 11.4 Ch	*162816*	169[14.0 Bl	210 10.3 Pt
158 11.8 Bl	169 8.6 Ht	RZ SCO	169 12.3 Bl	RT HER	T DRA
168 12.3 Bl	171 8.4 Dr	*155823*	W HER	170627	175458a
168 12.4 Sm	172 8.1 Dr	157 10.2 Ht	163137	210 12.5 Pt	205[12.5 GC
174 12.4 Sm	173 8.3 Ht	168 9.4 Sm	157 8.4 Ch	RW SCO	RY HER
S APS	174 7.5 Sm	169 9.3 Ht	210 10.3 Pt	*170833*	175519
145971	177 7.9 En	174 9.3 Sm	R DRA	158 12.0 Bl	145[11.7 Ch
155 10.1 En	180 7.5 Sm	176 9.3 En	163266	169 12.6 Bl	210 13.4 Pt
158 9 9 Bl	183 7.6 Ht	Z SCO	157 9.5 Ch	Z OPH	V DRA
164 9.9 Bl	Z LIB	*160021*	210 11.8 Pt	171401	175654
168 10.1 Sm	*154020*	157 9.7 Ht	RR OPH	210 8.2 Pt	210 10.5 Pt
170 10.2 Sm	169[12.4 Bl	164 9.1 Bl	*164319*	RS HER	R PAV
174 10.2 Sm	R CRB	168 9.6 Sm	168[12.0 Sm	171723	*180363*
175 10.0 Bl	154428	169 9.4 Ht	S HER	210 9 3 Pt	168 11.8 Sm
177 10.0 En	005 6.0 Kd	174 9.3 Sm	164715	S OCT	169 11.6 Ht
177 10.4 Sm	021 6.1 Kd	176 9.3 En	210 8.3 Pt	*172486*	173 11.6 Ht
182 10.1 Sm	023 6.0 Kd	X SCO	RS SCO	155[12.8 En	175 11.5 Sm
183 10.1 En	026 6.0 Kd	*160221a*	*164844*	169 11.5 Bl	176 11.0 En
S CRB	030 6.2 Kd	168[12.5 Bl	157 10.3 Ht	169 11.9 Ht	180 11.3 Sm
151731	042 6.1 Kd	SX HER	158 9.8 Bl	170 11.3 Sm	183 10.6 Ht
145 12.2 Ch	049 6.3 Kd	160325	164 9.2 Bl	175 10.7 Ht	183 10.3 En
217 7.2 Pt	052 6.2 Kd	189 8.0 L	168 8.8 Sm	176 10.5 Bl	T HER
RS LIB	061 6.1 Kd	197 8.4 L	169 8.8 Ht	177 10.6 En	180531
151822	065 6.0 Kd	208 8.7 L	173 8.6 Ht	177 10.6 Sm	145 10.4 Ch
157 7.8 En	070 6.0 Kd	210 8.7 Pt	174 8.1 Sm	183 10.4 Sm	186 8.4 L
157 7.5 Ht	076 6.3 Kd	214 8.6 Pt	176 7.8 En	183 10.6 Ht	197 8 4 L
164 7.5 Bl	084 6.1 Kd	217 8.2 Pt	176 7.9 Bl	183 10.3 En	198 8.6 GC
R NOR	094 6.0 Kd	220 8.0 Pt	180 7.5 Sm	RU OPH	199 8.4 Ch
153849	145 6.1 Ch	W SCO	183 7.4 Ht	172809	206 8.6 Wk
158 11.1 Bl	172 6.5 Kl	*160519*	183 7.2 En	210 12.2 Pt	208 8.6 L
164 10.5 Bl	178 6.0 Kl	168[12.0 Bl	185 7.0 En	RU SCO	210 8.7 Pt
166 10.9 Dr	181 6.2 Ch	RU HER	RR SCO	*173543*	W DRA
168 11.2 Sm	197 6.2 Kd	160625a	*165030*	158 8.5 Bl	180565
171 10.4 Dr	197 6.1 Be	208 13.7 L	022 7.3 Kd	164 8.1 Bl	203[13.5 B
172 10.4 Dr	197 6.1 L		023 7.4 Kd	176 8.5 Bl	
			052 6.6 Kd		

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1927.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
X DRA	R SCT	NOV AQL	RS LYR	SW SGR	RT CYG
180666	*184205*	184300	190933a	*191331*	194048
210 12.7 Pt	070 5.5 Kd	205 10.7 Ie	232 11.8 Eb	169[12.9 Bl	210 8.1 B
NOV OPH	076 5.4 Kd	205 11.0 Pt	RU LYR	TZ CYG	217 8.1 B
180911	084 5.9 Kd	210 11.2 Pt	190941	191350	224 7.3 Fd
210[13.0 Pt	089 5.9 Kd	214 11.2 Pt	210 10.7 Pt	210 10.6 Pt	227 8.5 Jo
TV HER	090 6.0 Kd	224 11.1 Pt	229 11.2 Kz	229 10.3 Sp	229 8.9 Kz
181031	094 6.0 Kd	NOV AQL	229 10.7 Eb	U LYR	229 8.7 Eb
186 10.9 L	097 5.9 Kd	*185003*	U DRA	191637	233 9.0 Hu
197 11.0 L	145 6.0 Ch	186 9.1 Be	190967	210 8.2 Pt	TU CYG
208 11.5 L	156 7.2 Gs	186 9.8 L	210 12.0 Pt	TY CYG	194348
RY OPH	178 6.1 Ch	RX LYR	232 11.1 Kz	192928	205 11.7 Pt
181103	179 6.5 Be	185032	232 11.5 Eb	157 11.9 Ch	209 11.9 Ch
210 8.7 Pt	186 5.7 Be	157[12.5 Ch	T SGR	207 12.8 Ch	229 10.3 Eb
W LYR	188 5.3 L	202 12.7 Ch	*191017*	210 12.8 Pt	229 10.0 Kz
181136	196 5.9 Kd	207 12.6 Ch	205 9.8 Ch	RT AQL	233 8.8 Hu
205 8.3 Jo	197 5.8 Kd	232 11.7 Kz	R SGR	193311	X AQL
206 8.2 Wk	197 5.8 Lg	232 11.7 Eb	*191019*	202 9.5 Ch	194604
210 7.8 Pt	197 5.5 Be	S CRA	151 8.5 Ch	210 8.3 Pt	210 10.5 Pt
211 8.0 B	197 5.4 L	*185437a*	205 11.8 Ch	232 8.5 Kz	229 10.4 Ya
232 9.1 Kz	198 5.8 Kd	158 11.6 Bl	RY SGR	232 8.7 Eb	X CYG
232 9.1 Eb	198 5.8 Ch	164 12.0 Bl	*191033*	R CYG	194632
RV SGR	199 5.8 Lg	169 12.1 Bl	157 6.9 En	193449	022 8.5 Kd
182133	201 5.8 Lg	176 11.7 Bl	157 6.5 Ht	205 13.3 Pt	203 13.3 B
158 8.0 Bl	201 5.8 Kd	R CRA	158 6.0 Bl	205[13.1 GC	205 12.9 Pt
164 8.0 Bl	202 6.0 Kd	*185537a*	164 6.4 Bl	210 13.1 Cb	207 13.5 Ch
176 8.4 Bl	202 5.8 Lg	169 13.0 Bl	168 6.8 Sm	210 13.0 B	232[11.9 Kz
SV HER	203 5.7 Lg	T CRA	169 6.5 Ht	214[13.3 GC	RR SGR
182224	203 4.8 Fd	*185537b*	169 6.5 Bl	226 12.5 Sb	*194030*
197[13.6 L	204 5.5 Sp	169 13.2 Bl	170 5.8 Sm	229 13.0 Lb	158 9.7 Bl
203[13.8 B	204 5.8 Kd	RT LYR	171 6.7 Dr	229[13.3 Pn	164 10.2 Bl
208 14.4 L	204 5.8 Lg	185737	172 6.8 Dr	231 11.9 Sb	176 10.5 Bl
210 13.8 Pt	204 5.8 Ch	202 11.9 Ch	173 6.5 Ht	232 12.0 Kz	RU SGR
T SER	205 6.0 Lg	207 11.1 Ch	174 6.5 Sm	232 12.0 Eb	*195142*
182306	205 5.5 Pt	232 10.1 Eb	176 6.8 En	RV AQL	155 8.6 Ht
210 10.8 Pt	205 5.7 Ie	232 10.0 Kz	176 6.0 Bl	193509	158 9.3 Bl
X OPH	206 5.9 Lg	R AQL	177 6.5 Sm	205 12.1 Pt	165 9.4 Bl
183308	207 6.0 Lg	190108	180 6.5 Sm	TT CYG	169 10.4 Ht
186 6.8 L	207 5.7 Pt	145 7.4 Ch	180 6.7 Dr	193732	170 10.0 Sm
201 7.1 L	208 6.0 L	203 9.5 Ch	182 6.5 Sm	233 7.5 Hu	173 10.5 Ht
205 7.3 Jo	210 5.5 Pt	210 9.0 Pt	183 6.5 Ht	T PAV	175 10.5 Sm
208 7.2 L	211 6.0 Lg	RW SGR	185 6.7 Dr	*193072*	176 10.2 Bl
210 7.4 Pt	214 5.4 Pt	*190819a*	186 6.4 Be	155[13.2 En	176 10.5 En
T AQL	214 5.6 Sp	205 10.3 Ch	186 6.3 L	169 13.5 Bl	182 10.9 Sm
184008	215 5.9 Lg	TY AQL	192 6.9 Dr	173[13.2 Ht	183 10.9 Ht
156 9.6 By	216 5.8 Sp	190907	197 7.3 Kd	175 13.2 Sm	185 10.9 En
RV LYR	217 5.7 Pt	210 10.8 Pt	197 6.0 Be	176 13.2 En	RR AQL
184134	217 5.9 Lg	S LYR	197 6.6 L	180 13.2 Sm	*195202*
210 14.4 Pt	218 5.9 Lg	190925	198 7.0 Dr	183[13.2 Ht	205 9.1 Pt
232[11.7 Kz	219 5.9 Lg	202[12.0 Ch	201 7.0 Dr	183 13.2 En	229 10.2 Ya
R SCT	219 5.7 Pt	X LYR	201 6.6 L	RT CYG	NOV CYG
184205	220 5.7 Pt	190926	202 6.5 L	194048	195553
022 5.8 Kd	222 5.9 Lg	198 8.9 By	TV SGR	145 10.6 Ch	205[12.4 Pt
023 5.8 Kd	223 5.8 Lg	210 8.8 Pt	*191121*	186 7.9 GC	210 12.2 Pt
030 5.8 Kd	224 5.5 Pt	RS LYR	164 12.7 Bl	202 7.9 Ch	214[12.2 Pt
042 5.3 Kd	229 5.3 Sp	190933a	S SGR	205 8.0 Pt	224[12.2 Pt
049 5.3 Kd	NOV AQL	150 11.1 Ch	*191319a*	205 8.0 Jo	229[12.1 Eb
054 5.4 Kd	184300	157 10.9 Ch	169[12.9 Bl	206 8.2 Wk	Z CYG
061 5.4 Kd	156 10.3 Ch	202 11.0 Ch	176[12.9 Bl	210 8.4 Cb	195849
065 5.6 Kd	203 10.4 Ch	210 11.3 Pt		210 8.1 B	145 12.0 Ch

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1927.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
Z CYG	Z AQL	WX CYG	V CYG	X DEL	T CAP
195849	*200906*	201437b	203847	205017	*211615*
203 12.6 B	207 10.5 Pt	205 11.0 Ch	157[11.8 Ch	207 10.4 Pt	170 12.5 Bl
206 12.7 Pt	211 10.6 B	207 10.5 Pt	207[13.1 Ch	214 10.3 B	176 12.3 Bl
229 12.5 Kz	R SGE	210 10.5 B	207 13.1 Pt	R VUL	203 11.8 Ch
229 12.6 Eb	200916	210 11.1 Cb	214 13.7 B	205923	S MIC
S TEL	204 8.9 B	212 11.2 L	Y AQR	202 9.3 Ch	*212030*
195855	229 9.1 Ya	U CYG	*203905*	205 9.3 Jo	170 12.8 Bl
169[12.6 Bl	RS CYG	201647	157 9.5 Ch	206 9.2 B	170 12.4 Sm
SY AQL	200938	157 10.8 Ch	203 10.9 Ch	207 9.0 Pt	176 11.8 Bl
200212	156 6.9 Ch	198 11.1 By	207 11.2 Pt	227 7.5 Jo	177 11.8 Sm
189 12.8 L	186 7.3 L	205 11.1 Ch	217 11.9 Wk	233 7.9 Hu	183 10.8 Sm
197 12.1 L	188 7.3 L	207 9.9 Pt	222 12.0 Wk	V CAP	Y CAP
206 11.0 Pt	197 7.2 Ch	210 10.3 Cb	T DEL	*210124*	*212814*
208 10.7 L	198 7.2 Ch	210 10.0 B	204016	169 12.0 Bl	156 11.4 Ch
211 10.8 B	199 7.2 Ch	224 10.0 Fd	157[12.2 Ch	176 10.9 Bl	170[12.9 Bl
218 10.6 Lg	200 7.4 L	227 10.8 Ch	203[12.2 Ch	TW CYG	203 10.4 Ch
223 9.5 Lg	202 7.2 Ch	229 10.3 Fd	214[13.6 B	210129	W CYG
R CAP	203 7.2 Ch	229 11.0 Sp	V AQR	214 12.5 B	213244
200514	203 7.5 Gb	U MIC	204 [illegible]	233 13.0 Ie	022 6.4 Kd
203 9.8 Ch	205 7.3 Jo	*202240*	157 8.5 Ch	X CAP	023 6.4 Kd
206 9.7 Pt	205 7.2 Ch	158 8.6 Bl	203 8.6 Ch	*210221*	042 6.4 Kd
SV CYG	206 7.2 Ch	165 8.7 Bl	203 8.9 By	169[12.7 Bl	052 6.3 Kd
200647	207 7.2 Pt	176 9.0 Bl	207 8.0 Pt	X CEP	054 6.2 Kd
198 9.6 By	210 8.9 Cb	SV CYG	W AQR	210382	061 6.3 Kd
214 9.4 By	212 7.5 L	202247	*204104*	203 12.4 GC	070 6.3 Kd
216 9.0 B	216 7.5 Sp	233 8.0 Hu	186 12.7 L	211 12.3 B	084 6.4 Kd
S AQL	227 7.6 Jo	Z DEL	197 12.1 L	RS AQR	089 6.4 Kd
200715a	R DEL	202817	202 13.4 L	*210504*	094 6.4 Kd
156 11.2 Ch	201008	211 11.8 B	203 13.6 B	186 11.1 L	095 6.4 Kd
198 9.8 GC	157 11.9 Ch	SZ CYG	208 13.2 L	197 10.8 L	097 6.4 Kd
203 10.0 Ch	186 10.1 L	202946	U CAP	198 10.9 GC	188 6.6 L
204 10.7 Lg	197 9.1 L	205 8.7 Pt	*204215*	207 11.0 Pt	196 6.7 Kd
204 9.5 B	203 8.7 Ch	206 8.8 Pt	169 13.2 Bl	208 10.6 L	197 6.6 Kd
206 9.8 Pt	206 8.9 Wk	207 9.0 Pt	211[13.6 B	Z CAP	197 6.2 L
211 9.5 Lg	207 8.4 Pt	210 9.0 Pt	V DEL	*210516*	201 6.6 Kd
217 9.3 Lg	208 8.6 L	214 9.6 Pt	204318	207 13.5 Pt	208 5.9 L
222 9.6 Lg	216 8.3 Sp	215 9.4 Pt	194 10.2 GC	R EQU	S CEP
229 10.0 Ya	229 8.5 Sp	216 9.6 Pt	203 10.6 B	210812	213678
RW AQL	RT CAP	216 9.7 B	206 10.6 B	207 10.0 Pt	205 8.6 Jo
200715b	*201121*	217 9.4 Pt	T AQR	216 9.6 B	207 8.2 Pt
198 9.4 By	061 7.5 Kd	219 8.7 Pt	*204405*	T CEP	210 9.2 B
204 9.0 Lg	084 7.6 Kd	220 8.8 Pt	157 10.6 Ch	210868	227 8.5 Jo
204 9.4 B	095 7.7 Kd	224 8.8 Pt	199 8.0 Lg	145 6.2 Ch	RU CYG
206 9.3 Pt	196 7.6 Kd	ST CYG	203 8.9 Ch	157 6.4 Ch	213753
211 8.8 Lg	202 7.7 Kd	202954	204 8.8 B	199 7.2 Ch	157 8.9 Ch
217 8.9 Lg	SX CYG	207 11.7 Pt	204 8.3 Lg	205 7.0 Jo	200 9.0 Ch
222 9.0 Lg	201130	211 12.1 B	205 8.3 Lg	207 7.1 Pt	206 8.5 Wk
229 9.1 Ya	204 9.1 B	V VUL	207 8.4 Pt	210 7.9 B	207 8.5 Pt
R TEL	207 8.5 Pt	203226	216 9.1 Sp	216 8.2 Gy	RV CYG
200747	RT SGR	207 8.5 Pt	217 8.7 Lg	227 7.7 Jo	213937
158 8.4 Bl	*201139*	R MIC	222 8.8 Lg	229 8.6 Gy	186 6.7 L
165 9.1 Bl	170 13.2 Bl	*203420*	229 9.6 Sp	231 8.8 Sb	200 6.8 L
176 9.3 Bl	WX CYG	158 8.8 Bl	RZ CYG	RR AQR	207 6.4 Pt
W CAP	201437b	165 9.3 Bl	204846	*210903*	212 6.8 L
200822	156 11.6 Ch	176 10.2 Bl	205 10.5 GC	207 12.0 Pt	214 7.0 By
158 12.0 Bl	186 10.8 L	S DEL	207 11.4 Pt	X PEG	216 7.5 B
169 12.7 Bl	188 10.8 L	203816	S IND	211614	233 7.2 Hu
	198 11.3 Ch	207 12.0 Pt	*204954*	207 11.0 Pt	
	201 11.3 L	210 11.9 B	170[13.5 Bl	210 11.2 B	

Variable Star Observations Received During December, 1927.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RR Peg	Y Peg	T Tuc	V Cas	ST And	Z Cas
214024	220613	*223462*	230759	233335	233956
210 9.5 B	210 12.3 Pt	155 8.0 En	210 11.1 Pt	203 10.1 Lg	180[13.5 B
210 9.1 Pt	211 11.8 B	158 8.1 Ht	211 10.7 B	206 10.6 Lg	RS And
221 8.9 Cl	RS Peg	169 8.1 Ht	W Peg	210 10.0 Pt	235048
R Gru	220714	170 8.4 Sm	231425	211 10.6 Lg	214 9.2 By
214247	211 12.9 B	173 8.1 Ht	171 9.0 Kl	213 10.7 Lg	RR Cas
169 12.6 Ht	T Gru	176 8.5 En	174 9.1 Kl	214 10.6 Lg	235053
170 12.6 Bl	*221938*	177 8.7 Sm	199 9.7 Kl	216 10.1 B	197 10.8 En
170 12.9 Sm	155 8.6 En	183 8.7 Sm	201 9.8 Kl	217 10.8 Lg	197 10.5 Ch
173 12.6 Ht	170 9.0 Sm	183 8.7 Ht	202 9.3 Ch	218 10.8 Lg	201 10.2 Bn
176 12.9 En	176 9.2 En	183 8.8 En	210 9.9 Kl	219 10.7 Lg	210 10.8 Bn
177 13.1 Sm	177 9.2 Sm	R Lac	215 10.0 Kl	221 10.4 Cl	210 10.6 B
183 13.4 Sm	183 9.6 Sm	223841	S Peg	221 10.8 Lg	V Cet
183 12.9 En	183 9.9 En	203[13.6 GC	231508	223 10.8 Lg	*235209*
V Peg	S Gru	214[13.6 GC	203 9.7 Ch	R Aqr	170 13.0 Bl
215605	*221948*	U Lac	210 11.2 Pt	*233815*	177 12.5 Bl
204 10.5 B	155[12.8 Bl	224354	210 10.9 B	155 9.3 En	R Tuc
210 11.2 Pt	169[12.8 Ht	214 8.7 By	V Phe	157 9.8 Ht	*235265*
216 11.2 B	170[12.8 Sm	RW Peg	*232746*	158 9.6 Bl	155 9.3 En
U Aqr	173[12.8 Ht	225914	157 9.5 Ht	165 9.2 Bl	168 9.4 Sm
215717	176[12.8 Bl	229 10.9 Sp	169 9.7 Ht	168 9.5 Sm	175 9.6 Sm
198 11.4 GC	183[12.8 Sm	232 10.7 Sp	170 10.0 Sm	169 9.7 Ht	176 10.8 En
204 11.5 B	RV Peg	R Peg	173 10.1 Ht	173 9.8 Ht	182 10.8 Sm
210 11.3 Pt	222129	230110	176 10.4 En	177 9.6 Sm	183 11.6 En
RT Peg	204 10.9 B	168 10.5 Sf	177 10.4 Sm	177 9.4 Bl	Z Peg
215934	S Lac	169 10.7 Sf	183 10.8 Sm	177 9.5 En	235525
204 10.9 B	222439	171 10.0 Kl	183 10.6 Ht	183 9.8 Ht	210 11.6 Pt
RY Peg	197 11.6 L	174 10.4 Kl	183 10.4 En	183 9.6 Sm	Y Cas
220133a	208 11.9 L	174 10.7 Sf	Z And	185 9.9 En	235855
210 13.0 B	210 12.5 Pt	181 10.9 Sf	232848	196 10.3 GC	210 10.4 B
RZ Peg	210 12.3 B	196 11.3 Sf	197 10.1 Ch	198 10.0 Ch	227 10.2 B
220133b	R Ind	199 11.0 Kl	210 9.8 Pt	200 10.1 L	SV And
210 9.1 B	*222867*	210 12.2 Pt	ST And	203 10.0 GC	235939
T Peg	158 8.9 Bl	214 11.8 Sf	233335	204 10.7 B	210 9.5 Pt
220412	165 9.3 Bl	217 12.8 Lg	197 10.0 Ch	205 9.9 Lg	215 9.7 B
198[13.5 GC	177 10.5 Bl		199 10.2 Lg	229 10.0 Sp	227 10.6 Cl

Rapidly Varying Irregular Variables.

005840 RX Andromedae—

5205.7[12.4 Pt	5215.8[11.7 Pt
5206.7[11.3 Pt	5216.7[11.3 Pt
5207.7 11.1 Pt	5217.7[11.7 Pt
5210.7 11.2 Pt	5220.7 11.5 Pt
5214.7 13.2 Pt	5224.7 11.2 Pt

060547 SS Aurigae—

5188.4[13.5 L	5212.6[12.4 L
5189.3[12.4 L	5213.8[13.5 Lg
5190.3[12.4 L	5214.6[13.8 B
5197.4[12.4 L	5214.7[12.6 Pt
5200.4[13.9 L	5215.7[12.6 Pt
5201.3[13.9 L	5216.6[13.3 B
5202.3[13.9 L	5217.8[13.5 Lg
5203.6[13.6 B	5218.8[13.8 Lg
5204.8[13.3 Lg	5219.8[13.3 Lg
5205.8[13.3 Lg	5220.6[12.0 Cl
5206.6[13.6 B	5221.6[11.0 Cl
5207.3[13.0 L	5227.6 11.8 Cl
5208.3[13.9 L	5223.6 11.7 Ie
5211.6[13.7 B	5224.7[12.4 Pt

074922 U Geminorum—

5162.4[12.4 Ch	5210.8 13.7 GC
5186.6 14.0 L	5211.7[13.6 Lg
5200.2[12.4 Ch	5212.6[13.7 L
5200.7[13.3 GC	5214.7[13.3 GC
5202.2[12.3 Ch	5215.8[13.3 Pt
5203.2[12.3 Ch	5217.7[13.0 B
5204.8[13.8 GC	5217.7[13.6 Lg
5205.7[13.0 GC	5219.7[12.4 Lg
5207.2[12.3 Ch	5220.9[12.4 Pt
5208.8[13.8 GC	5232.6[12.4 Ie

213843 SS Cygni—

5145.1 11.9 Ch	5190.3 12.0 L
5156.2 11.7 Ch	5196.5 12.0 GC
5157.3 11.8 Ch	5197.1 11.7 Ch
5186.3 12.1 L	5197.2 12.0 Be
5186.6 12.0 GC	5197.2 12.1 L
5187.3 12.1 L	5198.1 11.7 Ch
5188.3 12.0 L	5198.6 11.3 By
5189.3 11.9 L	5199.1 9.7 Ch
5189.3 11.9 Be	5199.3 9.3 Kl

RAPIDLY VARYING IRREGULAR VARIABLES.

213843 SS CYGNI—				213843 SS CYGNI—			
5200.2	8.7 Ch	5205.1	8.9 Ch	5211.6	11.4 B	5221.6	12.0 Cl
5200.3	8.8 L	5205.5	9.0 Ie	5212.2	11.7 L	5224.7	11.6 Pt
5201.2	8.7 Ch	5205.6	9.3 GC	5214.5	10.7 GC	5227.5	11.9 Lb
5201.3	8.8 L	5205 7	9.3 Pt	5214 6	11.4 B	5227.5	11.7 Pn
5201.3	8.3 Kl	5206.1	9.1 Ch	5214.7	11.7 Pt	5227.6	11.6 Bl
5202 2	8.9 Ch	5206.6	9.6 B	5215.6	11.4 B	5229.5	12.0 Pn
5202.3	8.9 L	5206.7	9.3 Pt	5215.8	11.7 Pt	5229.5	12.1 Lb
5203.1	8.9 Ch	5206.8	9.6 Wk	5216.6	11.6 B	5229.6	11.9 Kz
5203.6	9.0 Pn	5207.2	9.5 Ch	5216.7	11.7 Pt	5229.6	12.0 Fb
5203.6	8.8 By	5207.3	10.0 L	5217.6	11.8 P	5229.6	11.6 Sp
5203.6	9 2 B	5207.7	9.5 Pt	5217.7	11.7 Pt	5232.5	9.2 Sp
5204.1	8.9 Ch	5208.3	10.2 L	5219.7	11.7 Pt	5233.5	8.8 Ie
5204.6	9.3 GC	5208.6	10.2 B	5220.6	11.6 Cl	5233.6	8.7 Hu
5204.6	9.2 Pn	5210.6	11.0 B	5220.7	11.8 Pt		
5204.6	9.2 B	5210.7	11.4 Pt				

MONTHLY SUMMARY.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Allen	Al	7	8	Jones	Jo	18	29
Baldwin	Bl	98	185	Kanda	Kd	13	99
Barry	By	10	12	Kohl	Kl	8	32
Benini	Be	6	10	Kurtz	Kz	38	39
Bouton	B	91	117	Lacchini	L	41	109
Brown	Bn	3	8	Logan	Lg	18	67
Chandra	Ch	84	154	Lubrano	Lb	4	5
Cherrington	Cb	8	8	Peltier	Pt	182	254
Clement	Cl	9	12	Prentice	Pn	4	8
Dartayet	Dr	11	76	Rowley	Rw	2	2
Ebert	Eb	38	39	Smith, F.W.	Sf	2	11
Ensor	En	38	86	Smith, W.H.	Sm	49	128
Ford	Fd	9	16	Soberanes	Sb	4	7
Gaebler	Gb	3	3	Spears	Sp	12	20
Goodsell	Gs	4	5	Watkins	Wk	10	10
Gregory	Gy	2	3	Yalden	Ya	5	5
Houghton	Ht	36	101	Georgetown	GC	21	40
Hunter	Hu	14	14	Coll. Obs.	—	—	—
Iedema	Ie	9	10	Totals	36	355	1732

preferably in Right Ascension and Declination—direction of motion, in terms of position angle as for double star observations if possible, color, duration, length of train, etc. Special blanks will be sent to all who request them by addressing Professor C. P. Olivier at the Leander McCormick Observatory, University, Va., or the Recording Secretary at the Harvard Observatory, Cambridge, Mass.

LEON CAMPBELL, Recording Secretary.

January 9, 1928.

METEOR NOTES.

By CHARLES P. OLIVIER.

ANNUAL REPORT OF THE AMERICAN METEOR SOCIETY.

The year 1927 witnessed a considerable revival of interest in the observation of meteors, and our report shows the good effects. In the first table below are given the names of our contributing members, their stations, number of nights on

which regular observations were made, and number of meteors recorded. These last figures are sometimes provisional and in a few cases will be slightly revised. The second table gives similar data for telescopic meteors, but for some reason few reports on these have so far arrived. These reports are mostly sent in by members of the A.A.V.S.O., to whom we are greatly indebted for their past co-operation, which we sincerely hope will be continued. As usual, L. C. Peltier leads the list for telescopic meteors. We have again to thank the Chief of the U. S. Weather Bureau and the Commanding Officer of the Hydrographic Office, U. S. Navy, for most kindly mailing us copies of reports on meteors sent in to them, mostly by officers of ships. These reports, incidentally, are growing rapidly not only in number but also in value. In addition, we have received reports of single bright meteors from many individuals too numerous to mention.

TABLE I.

Observer	Station	Nights	Meteors
Anyzeski, V.	New Haven, Conn.	3	42
Bradley, F. L., Keller, H. L.	Staunton, Va.	1	40
Brown, H. D.	St. Paul, Minn.	1	8
Bunch, S.	Ft. Worth, Texas	13	332
Carr, F. J.	Swanton, Vt.	2	59
Culp, H .W.	.		10
Dole, R. M.	E. Lansing, Mich.	25	1185
Graham, A. V.	Denver, Colorado	2	35
Iedema, N.	Great Neck, N. Y.		4
Koep, J.	Chippewa Falls, Wis.	1	5
Lawrence, A. S.	Rockville Center, N. Y.	7	38
Logan, J. H.	Dallas, Texas	5	139
McIntosh, R. A.	Auckland, N. Z.	10	134
Monnig, O. E.	Ft. Worth, Texas	15	329
Olivier, C. P.	University, Virginia	10	224
Pegues, C. M.	Georgetown, Ky.	6	104
Watkins, G.	Caldwell, Idaho	2	30
Counts			206
Hydrographic Office, U. S. Navy			55
U. S. Weather Bureau			25
Miscellaneous			66
Total			3070

While no great shower of meteors appeared in 1927, our observers covered effectively the epochs of some of the best annual showers, and information of real value was secured. The maxima of the Pons-Winnecke meteors and the Orionids received special attention. The Leonids also were shown to have an increased activity. The largest number of observations was made by R. M. Dole, but so far only a résumé of most of his work has been received, and not the actual records. The greatest activity has been shown in Texas where Sterling Bunch, J. H. Logan, and O. E. Monnig have not only worked a great deal themselves, but have succeeded in arousing the interest of others, some of whom may become regular observers.

The publication of "Meteor Notes" in each issue of POPULAR ASTRONOMY has filled a real want. Through them preliminary results from work sent in by our members can be announced, and credit more effectively given. During the year, besides the ten "Meteor Notes" mentioned, two papers based on the work of the A.M.S. were presented by the writer at the meetings of scientific societies. He has also nearly finished the manuscript of the work covering the years 1919 to

1925 inclusive, which will be published when the necessary funds are found. As chairman of the Meteor Commission of the International Astronomical Union he has sent in preliminary reports, briefly covering work done in America.

The National Academy of Sciences has granted $200 from the J. Lawrence Smith Fund to the writer for purposes connected with our work, but principally to be used in a study of our records to test out Hoffmeister's theory of meteor velocities. One of our members, Alfred S. Lawrence, has generously had published at his own expense and donated to the Society several thousand blank forms for recording meteors, and is now having another set of forms for telescopic meteors as well as membership cards printed, which he plans to donate. These various gifts will greatly help our work and are hereby acknowledged with sincere appreciation. Blanks will hereafter be furnished along with the meteor maps.

TABLE II.

TELESCOPIC METEORS.

Chandra, R. G.	Jessore, India	4
Inglis, W. E.	Bridgeport, Conn.	1
Iedema, N.	Great Neck, N. Y.	2
Logan, J. H.	Dallas, Texas	2
Olivier, C. P.	University, Va.	2
Peltier, L. C.	Delphos, Ohio	59
Watkins, G.	Caldwell, Idaho	1
Watson, P. S.	Baltimore, Md.	2
Total		73

The headquarters of the A.M.S. now contain a very rich and valuable collection of meteor records. It is hoped eventually to make these more available to persons interested in this branch of science. Several fireballs were investigated, for one of which, that of February 27, 1927, over North Carolina, heights and an orbit were determined from 15 observations (see p. 91). Duplicate observations of others are on file, and may furnish similar data.

A valuable piece of original work has been done by Bunch and Monnig in Texas, working side by side and independently plotting the same meteors. A study of their maps will give material for finding out the probable correctness of many radiants. An even more important piece of work is planned by them in connection with Logan, by which the three observers, in different places, will observe for real heights.

While done entirely independently, no report on the subject of meteors in America would be complete without mentioning the very valuable work done by Dr. W. J. Fisher at Harvard College Observatory. He has already published several articles on fireballs observed over New England, as well as others dealing with different phases of meteoric astronomy. His final report on meteors photographed there is awaited with extreme interest.

Bulletin No. 9 of the A.M.S., containing a list of members, was issued on May 23, 1927. Since then we have had 16 persons to join. But many states still have no active observer, so more members are not only welcome but really needed. A cordial invitation is extended to all persons interested in the subject to write for information about our work, with a view to joining the A.M.S.

Leander McCormick Observatory, University, Va.
January 18, 1928.

COMMUNICATIONS.

Bright Meteor.—At about 6:38 E.S.T., on December 14, I observed a small meteor a little less in brightness than Jupiter. The color was similar to that of Jupiter, it left a red train about 3° long with a general west direction and a little south, visible about 3 minutes. It appeared to move very fast at first, then brightened and slowed down; next it seemed to speed up and disappeared behind trees that were near by. This meteor was also seen by another member of the Amateur Astronomers' Association of Natural Museum, New York City, about a mile north of me. The position to him seemed the same.

H. WEBB.

9251 173 Street, Jamaica, L. I., N. Y., Dec. 20, 1927.

Skjellerup Comet Discovered Anew.—I was a member of a party in a notch in the Sierra Madre Mountains—high up where the air was remarkably clear—December 15. At 2:00 o'clock P.M. as we looked down toward the sun which at that point was shadowed by a high mountain peak, one of the ladies discovered a planet (?) in plain sight, a few degrees above the sun, about 8 or 10 diameters of the sun disc above the sun. It did not appear as a point of light—like a star at night—but as a light gray body, a tenth or twelfth as large as the sun's disc. Its apparent size surprised me. If this planet (?) has clouds, the cloud effect may have made it appear larger, as one section looked "fuzzy" on the border. I am not a scientist—merely a machine man who often visits California—but I have always been interested in watching the changing positions of the planets. I will deem it a great favor if you will be so kind as to tell me if the above comments are in accord with the facts known to scientists.

J. E. GOODHUE.

545 Pioneer Drive, Glendale, California, December 17, 1927.

Professor Ritchey's Work in Paris.—Professor Ritchey has written me from Paris that a misconception has arisen in regard to some technical details of his work in his Paris laboratory, due to a note published in POPULAR ASTRONOMY in May, 1927, p. 301, and to my article in the December number, p. 551. These were both the result of the undersigned's failure to interpret properly the character and purpose of the tests referred to.

The comparison or test which Professor Ritchey made for the Paris Observatory as one item of his work there was that which he has recently described in *Comptes Rendus*, **185**, 1927, 1024, and much more fully in the January and February numbers of *L'Astronomie*, the *Bulletin* of the *Societe Astronomique de France*. This comparison is of the out-of-axis star-images and fields of two reflecting telescopes of his own construction, each having 20-inch aperture and 135 inches focal length; one of these is a Newtonian with mirrors similar to those of the 60-inch and 100-inch reflectors on Mt. Wilson; the other is an aplanatic reflector, a two-mirror type called by its inventors the Ritchey-Chrétien, to distinguish it from the other two-mirror type, the Schwarzschild.

These comparative tests were made in the laboratory, where temperature and atmospheric conditions were under good control, and were made with high magnification of the reflected images of an artificial star having a diameter of one micron. The 30-inch optically plane mirror, which he used as a collimating

mirror in making this comparison, was of the built-up, cellular construction invented by him and was made in his Paris laboratory three years ago. This plane mirror has been used frequently as an optical test-plane in the most exacting work, and has retained its figure so perfectly that no change can be detected after three years, with the most sensitive optical tests.

There seems no question whatever about the complete success of the cellular-mirror construction.

January 10, 1928. DAVID B. PICKERING.

GENERAL NOTES.

Dr. Frank Washington Very, director of the Westwood Astrophysical Observatory at Westwood, Mass., died on November 22 at the age of seventy-five years. (*American Journal of Science*, January, 1928.)

Dr. Charles Greeley Abbot has recently been elected secretary of the Smithsonian Institution, as the successor to Dr. Charles D. Walcott whose death occurred last year. Dr. Abbot is best known in astronomical circles for the important work he has done in determining the solar constant, which investigation is still in progress.

Professor Frederick Slocum, director of the Van Vleck Observatory, has accepted an invitation this year to give the lectures which have become an annual feature for the people in Miami, Florida. The lectures are given under the auspices of the Southern Cross Observatory. The issue of *The Herald*, Miami, for January 22, contains an extensive account of the history and present work of this observatory, indicating that the interest in astronomy in that section is greater than ever. The Southern Cross Observatory is to be highly commended upon the project and congratulated upon its success.

Dr. Max Wolf, director of Heidelberg Observatory, distinguished especially for his originality and activity in observational astronomy, was elected Honorary Member of the American Astronomical Society at its thirty-ninth meeting in New Haven. The constitution of the Society permits the election of only one honorary member at each annual meeting. There are but five other living honorary members, and the last election was made in 1924. The care which the Society exercises in its selection makes its choice a high honor.

The Next Planet Beyond Neptune.—This question has recently been under consideration by Professor William H. Pickering. His preliminary conclusion is that in 1928.0 the heliocentric longitude of the planet which he designates as *O* was 132°.4. Opposition should therefore occur on February 2, near $\alpha = 9^h\,00^m$, $\delta = +16°.5$. The magnitude at that time is determined as 11.5.

Request for Observations of Special Variable Stars.—The variable star commission (No. 27) of the International Astronomical Union requests from observers information concerning their work on the lists of variable stars published as Appendix B in the 1925 report of the Commission (Transactions of the International Astronomical Union, Vol. 2, pp. 104-113, 1925). The lists contain

important variables requiring special attention by trained observers. List 1 consists mainly of the variables of the types of R Coronae Borealis, U Geminorum, and RV Tauri; List 2, variables of irregular, peculiar, or unknown types.

Observers are requested to send a statement not later than May 1, 1928, to the chairman of the commission, reporting extent of observations during the last three years, giving references to publications of observations, and stating whatever new conclusions they may have reached concerning the nature of the variability of any of these stars.

It is proposed to plan at the next meeting of the Union further concentrated work on important or neglected variable stars, basing the plans on the reports of progress during the last three years.

HARLOW SHAPLEY,
Chairman of Variable Star Commission.

Harvard College Observatory,
Cambridge, Massachusetts, December 27, 1927.

Astronomy as a Church Enterprise.—The First Unitarian Church of Los Angeles, California, has recently installed an astronomical telescope on the roof of the parish house of the church. The instrument is a 6-inch Brashear refractor, with equatorial mounting and driving mechanism. In charge of an attendant, it is open to the public one evening of each week to view the more common celestial objects.

The Henry Draper Extension.—*Annals of Harvard College Observatory*, Vol. 100, No. 3, recently issued, furnishes to those engaged in astrophysical and astronomical research a list of five thousand stars with their individual spectral classification. This work was done by Miss Annie J. Cannon and is a part of the extension of the Henry Draper Catalog. The current number of this catalog is here carried forward from 231.300 to 236.300. The table is in a condensed form so that the entire list is included in sixteen octavo pages.

Reductions of Occultations Recently Observed at Leonia, N. J.—The observations were made at my observatory, Lat. 40° 51′ 50″ N, Long. 73° 59′ 19″ W. with a 4-inch Clark refractor, stop watch, and Frodsham chronometer. Rate of time-piece was determined by Arlington time signals. Formulas used in the reductions are those by R. T. A. Innes, *Ast. Jour.*, No. 835, as modified by the Yale University Observatory.

IMMERSIONS.

No.	Star	α' = R.A. h m s	δ' = Dec. ° ′ ″	Limb	Date 1927	G.C.T. h m s	$\chi - \rho$ ° ′	$\sigma' - \sigma$ ″
1	24 B Cet	0 6 34.98	— 5 39 9.1	B	June 22	8 52 19.1	—65 41	+2.6
2	ϵ Tau	4 24 21.07	+19 1 12.7	B	July 24	9 22 11.6	37 11	+0.1
3	51 Sgr	19 31 38.24	—24 52 44.3	D	Aug. 11	3 34 51.0	25 35	—0.9
4	χ Cap	21 4 25.38	—21 29 8.4	D	Sept. 9	2 49 51.3	— 6 54	+0.2
5	33 Psc	0 1 38.33	— 6 6 41.6	B	Sept. 12	4 49 26.3	7 43	—0.2
6	148 B Tau	3 49 1.13	+17 6 47.2	B	Sept. 16	6 33 1.0	48 27	+3.8
7	37 Cap	21 30 47.59	—20 24 30.6	D	Oct. 6	22 59 36.5	64 10	+3.1
8	ϵ Cap	21 33 1.99	—19 47 30.4	D	Oct. 7	0 25 21.9	—41 47	—0.8
9	κ Cap	21 38 37.33	—19 11 50.9	D	Oct. 7	3 52 0.2	—39 7	—1.6
10	λ Sgr	18 23 28.88	—25 27 51.4	D	Oct. 31	0 20 33.4	—11 40	—0.3
11	30 Psc	23 58 15.40	— 6 24 57.1	D	Nov. 6	0 55 21.4	—40 31	—0.3
12	25 Ari	2 23 33.17	+ 9 52 45.1	D	Dec. 6	2 56 9.8	41 3	+1.8

J. ERNEST G. YALDEN.

Leonia, N. J., January 9, 1928.

Summary of Sun Spot Observations at Mount Holyoke College, 1927.

Month	North of Equator No. of Obs.	No. of Groups	Av. Lat.	South of Equator No. of Groups	Av. Lat.	Av. No. at one Obs.	New Groups
January	14	8	+17°.9	15	—14°.5	5.14	23
February	21	11	18.8	11	14.8	5.62	16
March	22	10	18.7	11	13.6	4.14	18
April	23	9	16.4	13	15.8	5.04	19
May	12	10	15.9	14	14.9	5.00	23
June	11	7	17.8	2	17.6	3.00	7
September	8	8	20.2	5	11.5	4.38	13
October	18	13	20.4	11	14.0	3.89	21
November	13	7	15.9	9	7.7	3.15	16
December	18	5	18.4	9	10.6	2.18	12
Totals	160	88		100			168

Average number at one observation	4.29
Average latitude of groups north of equator	+18°.19
Average latitude of groups south of equator	—13.29

No spots were found on March 30, but the seeing was very bad. A small group seen the next day 50° east of the center was probably coming on.

Most of the observations of the first half year were made by Miss Hazel Burton and those of the second by Miss Catherine Stillman.

ANNE S. YOUNG.

John Payson Williston Observatory.

WILLIAM WALLACE PAYNE,

founder of POPULAR ASTRONOMY and prominent as a worker in the science of astronomy for more than half a century, died at his home in Elgin, Illinois, Sunday night, January 29, 1928. An account of his long, active, and fruitful career will be given in a succeeding issue.